Model Engineer

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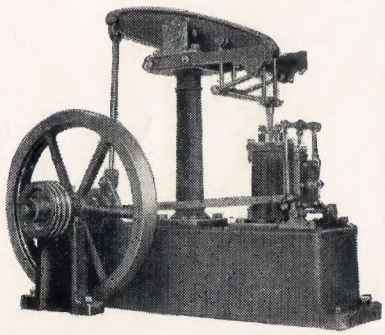

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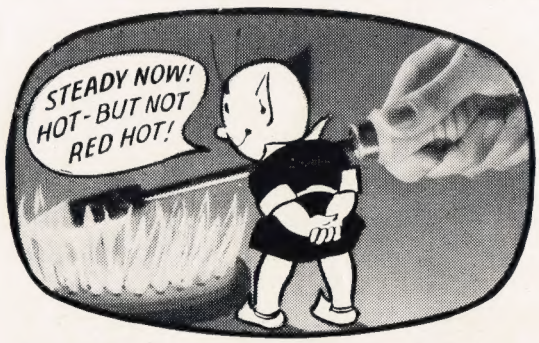

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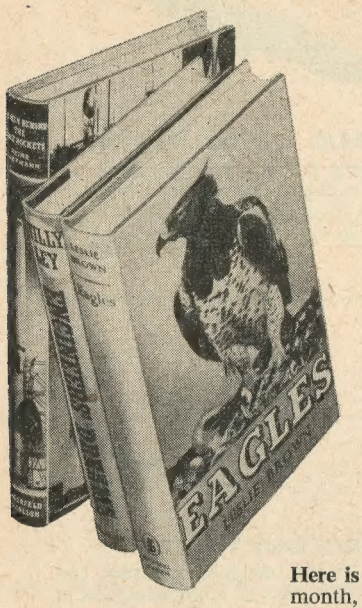

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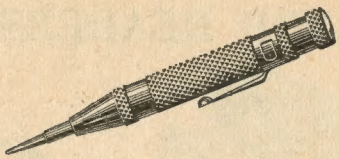

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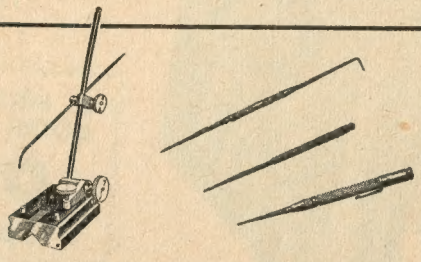

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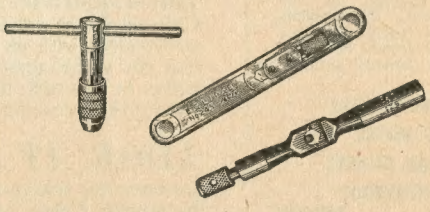

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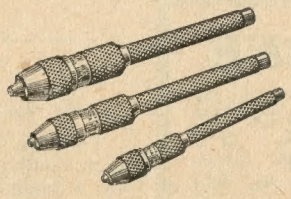

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All correspondence should be addressed to the Editor, Model Engineer, 19-20, Noel Street, London, W.1.

Smoke Rings

A WEEKLY COMMENTARY BY VULCAN

BESIDE me on my desk lies a rough pencil drawing on a yellowish oblong of tracing paper about 11 in. × 5 in. One day, I suppose, it will rest in the Imperial War Museum.

The drawing is the first sketch ever made of the mechanism of the Sten gun. It belongs to H. J. Turpin, of Enfield, whose article in this issue on a cinematograph tripod will be read with interest and profit, like the many other articles which he has contributed to MODEL ENGINEER in the past.

Mr Turpin drew the sketch at home in an air-raid shelter on the night of 2 December 1940, for it was there that he conceived the idea which took shape in the most famous gun of modern times. The gun's name, which struck many people when they first heard it in 1941 as something very new in the English vocabulary, itself commemorates his achievement. It is composed of initials: S for Lt-Col R. V. Shepherd, the arms expert who was Mr Turpin's chief at the Ministry of Supply; T for Turpin; and En for England.

At first, when the newspapers of Britain and America were rejoicing in the new weapon, the names were kept secret and Mr Turpin was known only as "Mr T."

First to know

Fittingly enough, the first people apart from top-ranking experts to know the full technical details of the gun and its ease of manufacture from simple materials were the readers of MODEL ENGINEER [3 June 1943]. Here was Mr T of the Sten gun, himself a model engineer, describing his historic contribution to victory. . . .

Mr Turpin was born at Plumstead. After serving his apprenticeship with Fraser and Chalmers, of Erith, until he was 21, he moved to Vickers at Crayford and eventually, in 1922, he joined the Armaments Design Department of the Ministry of Supply. He had experience of small arms work in both world wars, for it was at the time of his move to Vickers that the 1914 war began.

Since his retirement in 1953 he has been able to devote more time to model engineering and to cinemaphotography, another of his interests. As a member of Chingford M.E.C. he is a familiar figure to the children at Ridgeway Park who delight in riding on the Chingford track.

He enjoys their happiness—but one thing that he dislikes is the sight of a child with a toy gun. "I never fire a gun," he says, "and I never handle one. I dislike the things!"

What goes up . . .

A GOODS train without an engine broke away and started to roll down an incline at Flaggy Rock, 136 miles north of Rockhampton, in Queensland, Australia.

The train crew hastily set after it in the engine, but it took them three

SMOKE RINGS . . .

miles to get within catching distance, for the runaway had gathered speed down the long slope.

Suddenly the enginemen's faces took on a puzzled look. Were they chasing the train, or was it chasing them? For now the goods wagons were coming towards the engine. Could they reverse in time? They could not. There was a crash which derailed one wagon and damaged four others, but no one was hurt.

The crew had overlooked one elementary fact governing the laws of gravity: what goes up must come down. When a runaway train, impelled by its own impetus, tries to ascend an incline after descending a long grade it is only a matter of time before it changes its mind about the direction in which it wishes to travel —which certain enginemen are likely to remember for a long time.

Back to nature

WHILE the world thinks of power in terms of the atom and electronics, in rural Witney, where the blankets come from, they have turned their attention to one of the oldest sources of power—the waterwheel.

Some years ago electric motors replaced the decrepit waterwheel which used to pump water for the Burford Water Company. But Witney Rural District Council decided, apparently in the interests of economy, to revert to water power and a new wheel was ordered from J. Godfrey and Son, of Buckland.

The proprietor, John Russell Godfrey, built the wheel in sections with the aid of his assistants and assembled it on the site. It is 13 ft dia., 9 ft wide and weighs four and a quarter tons.

According to the *Oxford Mail*, Mr Godfrey was able to incorporate the three cast-iron spider wheels from the old waterwheel.

A colleague in the office is now considering plans for a steam-operated typewriter. . . .

"Virginia" in U.S.A.

I HEAR from my American friends that the model engineering fraternity over there are thrilled with the idea of building *Virginia*, which is a typical American-style 4-4-0 locomotive of the 1880s.

The fact that L.B.S.C. has given them alternatives of Walschaerts' and Stephenson's gears, balloon and diamond smokestacks and two types of boiler has pleased them immensely as each constructor can build the engine to his own particular fancy, which appears to be an important characteristic of model locomotive engineering the "other side of the pond."

Refreshing news to our American colleagues, too, is that Avery McCune, of the B. and B. Shop, 10, High Street, Morristown, N.J., is offering the necessary castings and drawings for *Virginia*. The castings are by Wilwau, a price list already being available.

Now, who will be first to finish a *Virginia*? America or Britain?

Concrete footbridge

LATTICE-GIRDER and vertical-plate bridges which have for years remained unchallenged as the basic types for railway footbridges now have a serious competitor—the prestressed concrete bridge.

The Eastern Region of British Railways has just completed a new footbridge in this medium at Scunthorpe station, the total length of the new bridge being over 600 ft.

Ramped approaches on each side are 120 ft leaving a middle section of over 370 ft straddling the five running lines and 22 sidings in five giant leaps.

The prestressed beams are 6 ft deep and vary between 67 and 86 ft in length. They are supported on trestles 19 ft high with a base width of 15 ft, giving a clearance above rail level of 15 ft 7 in.

This innovation seems to offer advantages to the railway modeller for it is obviously much quicker and cheaper to simulate a concrete bridge than to copy faithfully the style of lattice and vertical-plate bridges with their complexity of cross members and rivets.

H. J. Turpin, about whom I write this week, driving his 2-8-2 locomotive LIKEADA *round the Ridgeway Park track*

Cover picture

This superb model of Caledonian Railway's locomotive No 76 is in the Royal Scottish Museum. The prototype has driving-wheels 8 ft 2 in. dia.; the model is to the scale 1 in. to 1 ft.

Progress Down Under

GLANCING the other day at one of the latest handbooks issued by the Australian Government I was interested to see that the Commonwealth now boasts 33,000 miles of railways—such has been the development in that sphere in recent years.

All except about 700 miles are owned and operated either by the Federal Government or the states. They comprise 10,000 miles of standard 4 ft 8½ in. gauge, 8,000 miles of 5 ft 3 in. and 15,000 miles of 3 ft 6 in. and under.

Diesels are replacing steam locomotives on many of the long-distance runs, particularly on the east-west transcontinental service between Kalgoorlie, Western Australia, and Port Pirie, South Australia. These modern locomotives have made considerable cuts in timetables. For example, the 1,108 miles between Kalgoorlie and Port Pirie took nearly two days to cover in the days of steam; today diesels do the job in 24 hours.

Air conditioning is standard equipment on most long-distance journeys —and with the installation of showers much of the inconvenience that once was inseparable from train travel has been banished.

Some further notes on—

THE AMERICAN TRACTION ENGINE

By Geoffrey K. King

In my earlier article (see issue of 22 November, 1956, pages 719-721) I outlined some of the main points of difference between English and American practice, but, of course, many points were not dealt with and a number of very interesting types were not even mentioned.

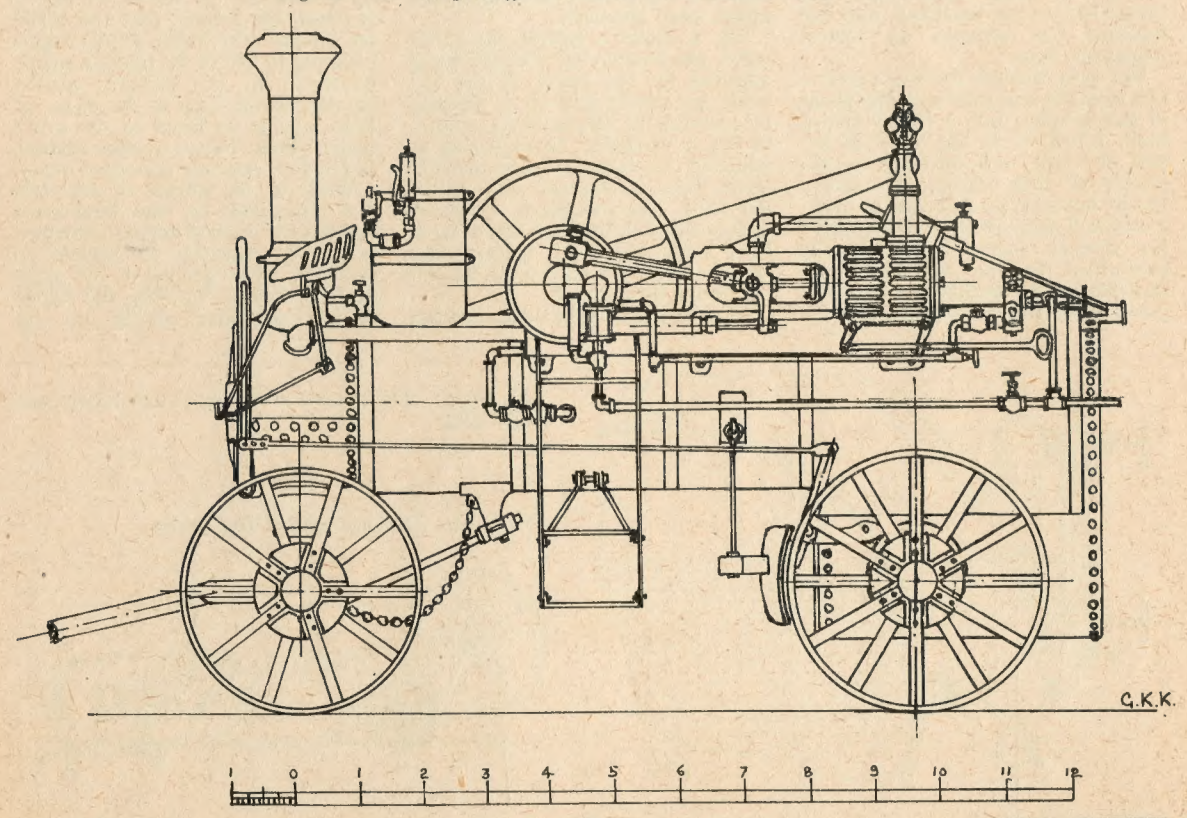
To deal further with some of the designs already mentioned it will be noticed that no brakes are shown on any of these engines and very few American or Canadian engines were fitted with them. Mr C. A. Butterwick of Nemiskam, Alberta, who has had a long, practical experience of traction engines, attributes this to the fact that the engines were mainly single speeders geared to a very low speed (2 to 2½ m.p.h.) and that their greatest use was for direct-traction ploughing on the prairies where the need for a brake was rare.

He also gives me the information, which I did not previously possess, that two makers, Rogert Bell of Seaforth, Ontario, and the Port Huron Co. of Michigan, equipped their engines with a gear-lock. This was claimed to save the work of scotching the wheels when used for belt work. It consisted of a bracket bolted direct to the boiler with a dog that could by the use of a lever be dropped into the teeth of the intermediate gear wheel. Mr Butterwick describes this as "a very severe and highly questionable accessory"—an opinion with which I certainly agree.

The governor appears to have served an even more important purpose across the Atlantic than it did here, as it was usually used on the road as well as on belt work. In this country, so far as my own observation goes, it was never used when travelling and its use on the road must have meant a rather different technique on the part of drivers. The English driver was more inclined to dispense with the governor even on belt work when it was really a rather risky proceeding.

The driver of a very fine single-crank compound Burrell showman's engine—well known in our extreme youth to both Mr Butterwick and myself—was fond of running it belted to the dynamo without the

Fig. 5. An 18 h.p. Buffalo Pitts portable engine, circa 1906



AMERICAN TRACTION ENGINE . . .

belt on the governors. When tentatively questioned as to the reason for this he told us that he could adjust it to run more steadily by hand, from which I gather the governor was inclined to hunt. The load consisted of a ring of arc lamps hanging over a set of Tidman galloping horses so I suppose it was fairly constant, but for all that I did not think it was a very safe arrangement—an idea which was strengthened later when I actually saw a gas engine driving two big chaff cutters "run away" through a governor failure.

Were the American governors more free from hunting than ours? I think it is more probable there was some slight defect in the adjustment of those on this particular Burrell.

There are several points of interest about the Case engine illustrated in the previous article. One of these is the position of the water gauge on the side of the boiler barrel (left side) instead of on the backhead, and this position was adopted by several American firms.

The only English traction engine I can recall having seen with the gauge in this position was a Robey engine built, I believe, in the late '70s but still at work well into the second decade of this century. It had a special lamp beside it for use at night. I believe Robeys retained this position for several years, but eventually conformed to the normal British position on the backhead. The side position for this important mounting always seems rather an attractive one for a working model. The arrangement of the Case water gauge and its accompanying column is shown in Fig. 1.

An independent steam feed pump is shown in my drawing, but Case engines were more usually fitted with a double-acting pump driven by gears from the crankshaft at about half-engine speed. This pump is shown diagrammatically in Fig. 2. It delivered the water to the boiler by the feed-water heater shown, the exhaust steam passing through tubes in the body of this heater on the way to the chimney.

The small door on the left-hand side of the firebox is known as the peep hole and opens into the firebox just behind the tube plate. It is particularly useful when a brick arch is used, as in straw burning, because it gives access to the top of the arch and the operator can observe the flame and remove any straw from the tube ends.

The piston-rod stuffing boxes on the Case, Sawyer-Massey, Russell and many other American engines had the gland adjustable by a large cap nut embracing it—though other engines, such as Buffalo Pitts, employed studs as in English practice. The Sawyer-Massey arrangement is shown in Fig. 3 and Case, Russell and others were identical.

Fig. 4 shows a typical pop safety valve, the blowing off pressure being adjusted by the screw at the top while the closing pressure is adjusted by screwing the valve seat up or down in the valve casing, so increasing or reducing the clearance under the edge of the valve. The small screw on the left locks this movement, provision being made for close adjustment by at least every eighth of a turn. The lever is to lift the valve from its seat for testing or cleaning.

Most of the traction engine builders made portable engines and these were usually modifications of their traction engines, hence a certain variety was found here also. They seem to have usually been fitted with a driving seat beside the smoke stack—in fact on some engines it was actually on the smoke stack itself; the driver in this latter case sat astride the lowered stack. From this somewhat precarious position the driver handled his team and because of this the engines were also fitted with powerful brakes operated by a lever beside the driver, a curious reversal from English practice where brakes, though usual on tractions, were seldom used on portables, it being the custom here to lead the horses and if necessary to use a shoe on a chain to check the engine.

A typical portable engine of 1906 by Buffalo-Pitts is shown in Fig. 5 in which the driver's seat and brake are shown. The boiler of this engine is similar to that of the traction engine illustrated in my previous article, but the engine itself is the 8½ in. × 12 in. engine as fitted to the arm's single cylinder 18 h.p. traction engines, with a disc crank and crosshead pump.

While on the subject of portables it is remarkable for how long horse steerage for traction engines remained in use in America, as engines so arranged were produced by some firms as late as the '80s, the horse-driving steersman sitting on his

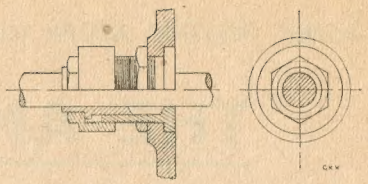
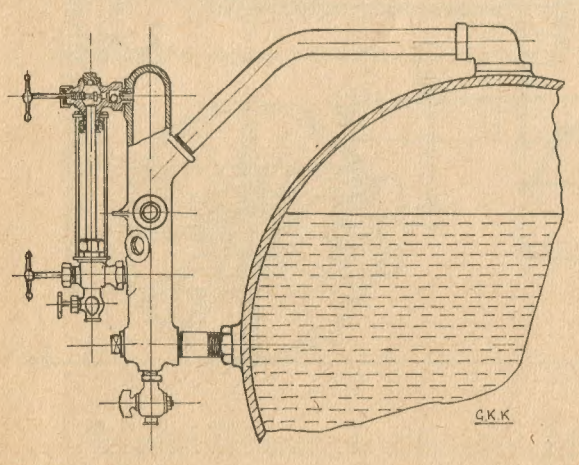
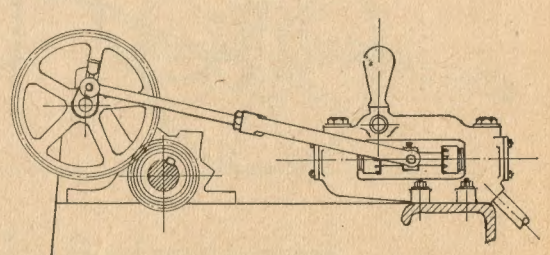


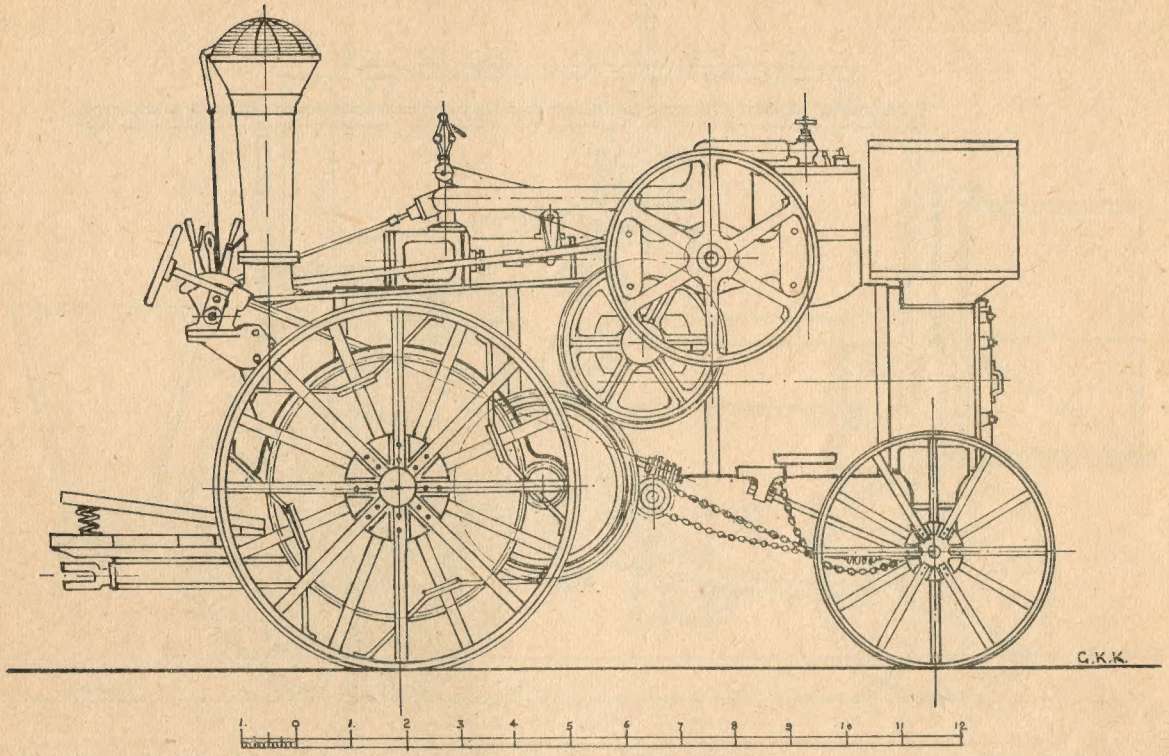
Fig. 3: Sawyer-Massey stuffing box and gland



Left, Fig. 1: Arrangement of the Case water column and gauge glass

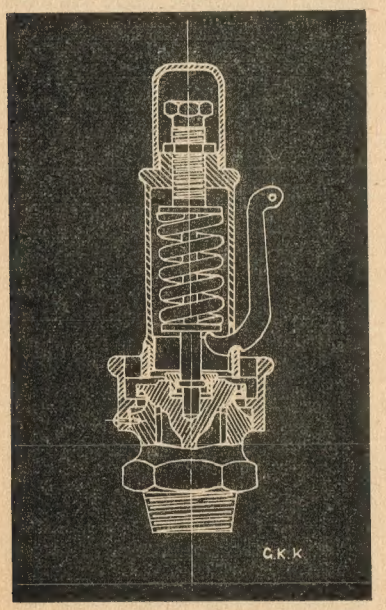
Below, Fig. 2: Case geared feed pump





Above, Fig. 6: A 25 h.p. Buffalo Pitts single-cylinder engine with return tube boiler, circa 1906

Below, Fig. 4: Typical pop safety valve



seat high up in front while the engine driver stood on the manstand behind the engine. Some makers allowed for either method, providing a steering wheel for control from the footplate but retaining the horseman's seat in front.

Many American firms produced engines with return flue boilers, among them Buffalo Pitts, who supplied them as an alternative to their usual locomotive-type boiler. Fig. 6 shows an outline of a 25 h.p. single-cylinder engine of this type, the boiler adapted for strawburning having a barrel diameter of 37½ in. (under the lagging), a firebox 36 in. high 44 in. long and 30 in. wide and a grate area of 9.166 sq. ft. A 15 in. flue conducts the hot gases to the front smokebox, from which they return to the rear by twenty-one tubes 3 in. dia. and 10 ft 6 in. long, where an uptake leads them to the smoke stack. The cylinder is 10 in. bore × 12 in. and the flywheel is 46 in. dia. with a 10½ in. face, normal speed 250 r.p.m. The rear wheels are 78 in. dia., 24 in. face, front wheels 51 in. dia., 12 in. face, with 9 ft 8 in. wheelbase and an overall width of 8 ft 9½ in. Most of the details correspond to those of the firm's standard locomotive boilered engines.

A firm which appears to have concentrated entirely on engines with return tube boilers was the Humber Manufacturing Co., Marion, Ohio. Most of these were single-cylinder engines with disc cranks and the cylinder placed well back alongside the smoke stack. A few of the early ones appear to have had the flywheel on the left, but later ones had it in the more usual American position on the right. The boilers differed considerably from those of the Buffalo Pitts engine just described.

The furnace is in the large central tube, the boiler shell being cylindrical throughout its length. This enabled it to be mounted above the rear axle, which was therefore neither side nor rear but under-mounted. This gave the engine excellent ground clearance when working through streams or over tree stumps. Like most other American engines this axle was "dead" and the wheels driven independently from a countershaft carrying the compensating gear. This compensating gear was of the all-spur type instead of the bevel-gear pattern favoured by most American makers. Superheating was secured by taking the steam pipe through the main flue. The water tank in front of the smokebox was arranged to swing when it was desired to open the smokebox.

In 1907 the Humber Manufacturing Co. produced a two cylinder engine of

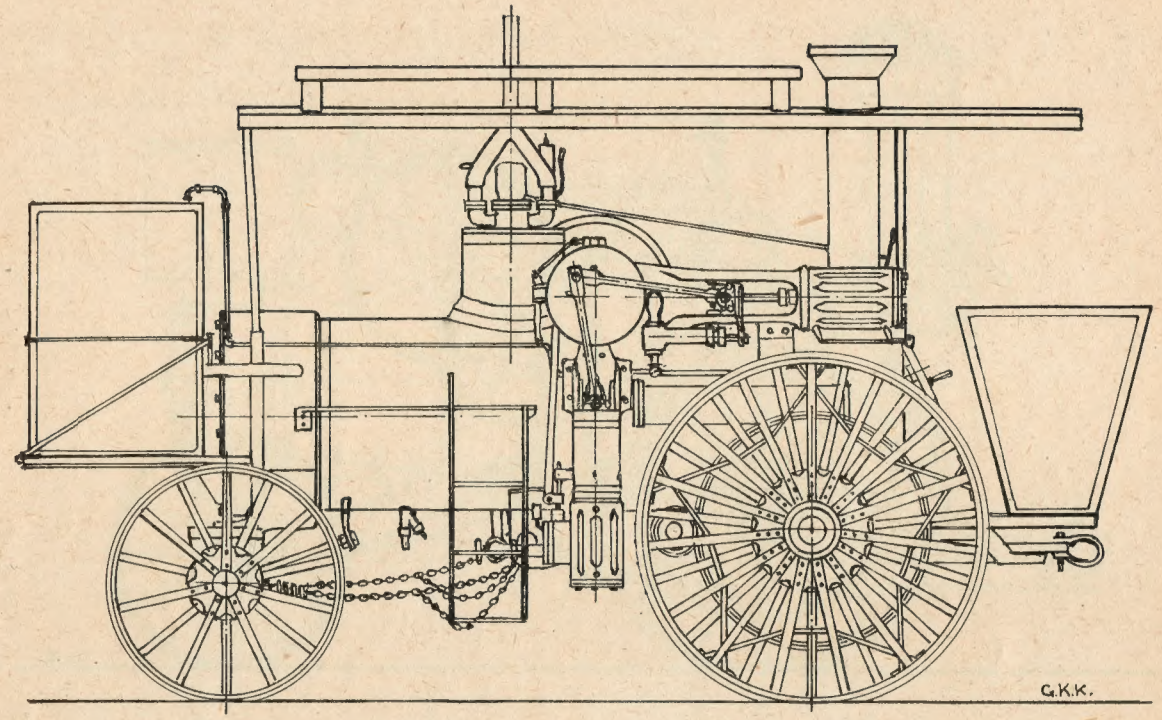


Fig. 7: A 31 h.p. Humber Mfg Co. double-cylinder engine with return tube boiler, circa 1907

AMERICAN TRACTION ENGINE . . .

a very unusual type. It had one cylinder in the same place as their standard single-cylinder engines with the usual disc-crank, but a second cylinder was added below the crankshaft driving up on to the same crankpin (Fig. 7). Exact dimensions are not known, but the drawing shows the approximate proportions of this curious engine. The two cylinders appear to be identical except that the vertical one is turned so that the valve chest faces the front and the vertical connecting rod is considerable shorter than the other. Two sets of valve gear appear to be employed, coupled to one eccentric.

Several makers built engines with vertical boilers in the '80s and '90s, at least two continuing their manufacture into the present century.

The Westinghouse of the '80s had a vertical boiler with a horizontal engine in front of it and was made in three sizes, 6, 10 and 15 h.p., the largest weighing under five tons. The drive to the second motion shaft was by vee belt and in the two bigger sizes two pairs of pulleys were provided, giving two speeds by changing the position of the belt. The driven pulley could be moved towards or away from the crankshaft by a tightener, which seems also to have been used as a clutch, and when the belt was released the driven pulley was brought in contact with a brake. This latter was a necessary provision to enable the belt to be changed—to change speed—and also, one supposes, to hold the engine if the belt broke. The engines could be adapted for steerage by horses or by a steering wheel. Three pictures of these engines were reproduced on pages 810 and 811 of MODEL ENGINEER for 17 May 1956.

The Canton *Monitor* of the early '90s was a somewhat similar engine, with a vertical multi-tubular boiler having a vertical engine in front of it, the cylinder being below and the crankshaft above. The driver's seat in front was nearly over the front axle, with a steering wheel at his right-hand side. It could also be arranged for horse-steerage.

The most interesting of these vertical boilered engines were probably those made by the Best Manufacturing Co. San Leandro, California. These were mainly big three-wheeled engines with double-cylinder horizontal engines in front of the boiler. As early as 1889 they were advertised for pulling giant combine harvesters with a cut 24 ft wide, the power for driving the combine being produced by an independent steam-engine supplied with steam from the boiler of the tractor by a flexible pipe. In later years they made very large engines for logging and for heavy road haulage. I have little information or details of these engines, but one built about 1905 had driving wheels eight feet in diameter and 26 in. wide.

Next I hope to discuss some of the compound engines produced in America and the ingenious-balanced slide-valves used on some of the simple engines.

SOME time ago Denfords Engineering Co., of Heckmondwike, Yorks, produced a book, *Know Your Lathe*. Demands were so heavy that it was quickly disposed of and a reprint was put on order. This is now to hand and any one requiring a copy should make direct application to Messrs. Denfords.

GEOMETER discusses methods employed in using the lathe for milling work

BEGINNER'S WORKSHOP

SETTING VERTICAL SLIDES

AN IMPORTANT ASPECT of the lathe, from the amateur's point of view, is that with the minimum of equipment it can be employed for light milling operations.

Taper-shank end-mills can be mounted in the spindle, while parallel-shank mills and facing cutters can be held in a chuck. Using a stub mandrel in a chuck, or a long mandrel with one end in the chuck and the other by the tailstock, various types of circular cutters can be run for sawing, slotting and similar operations.

For very simple operations, the work can often be clamped to the top-slide and traversed past the cutter by cross-slide and longitudinal feeds. In some instances, the topslide can be removed and an angle-plate substituted, thus providing a larger surface for mounting. The most versatile fitting, however, is a vertical slide which can be fitted in place of the topslide.

Given such a slide, the basic accuracy of the work produced on it will largely depend on the setting. Usually, the bases of slides are graduated to provide approximate settings, but these are not nearly accurate enough and should not be relied upon—except, perhaps, for very simple operations.

For more precise settings, involving normal parallel and right-angle faces, the face of the slide must be adjusted to correspond with the cross-slide or saddle feed. This can be done either with a round-ended pointer, or preferably with an indicator gauge—to show errors in setting by the movement of its hand.

Referring to diagram *A*, showing a plan view of a slide set at right-angles to the lathe axis, a round-ended pointer could be mounted on the driving plate, and the slide fed near to it. The gap between pointer end and the face of the slide should be equal across the face as the slide is fed, and may be checked by observation or using feeler gauges.

If an indicator is mounted as shown, any error will be revealed as a variation in the reading of the indicator, and when the reading is steady the slide is correctly set. With either method, should an error be shown the slide must be suitably re-adjusted.

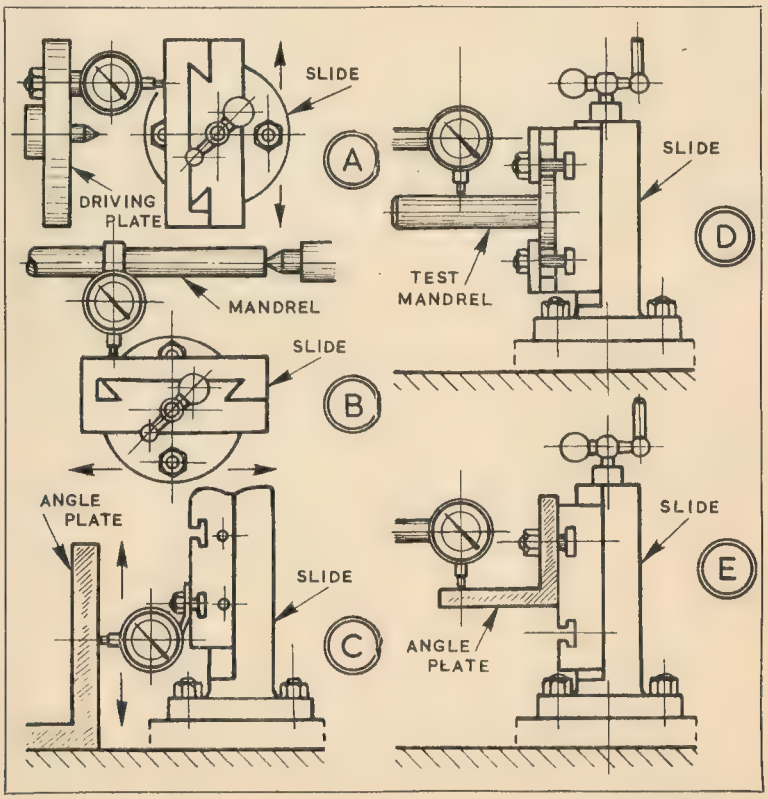
Referring now to diagram *B*, where the slide has been turned through 90 deg., a round-ended pointer or indicator can be mounted on a mandrel, held one end in the chuck, the other supported by the tailstock. Similar principles of setting are then employed in conjunction with saddle feed along the bed.

These two basic settings cover the majority of set-ups; and for adjusting work true on the slide, the same principles apply. Thus, should it be required for the edge of a component to run parallel with the lathe bed, the round-ended pointer or indicator is moved into a vertical attitude.

With crossfeed for diagram *A*, or saddle feed for diagram *B*, a level setting should then be obtained. If feed is to be from the vertical slide itself, the pointer or indicator should be set to the edge of the work, and the gap or reading should be uniform as the work is raised and lowered. In every case of inaccurate setting the work must be adjusted on the slide.

In regard to accuracy of the slide itself, any error shown by the table against a fixed indicator when the vertical slide is operated would suggest an error in the table. This method, however, would not reveal an error in the guideways of the slide. To do this, a test would have to be made, either on the lathe or a surface plate, against a true angle-plate, as at *C*, or using a test mandrel, as at *D*, machined between centres. An inaccurate slide can be packed at its base.

The setting of an angle-plate can be checked as at *E*, with saddle and cross-slide feeds. Inaccuracy on the plate can be corrected by packing, and the other way by suitably adjusting the plate on the slide table. ▣



The MUNCASTER steam-engine models

3—Simple slide-valve engines

EDGAR T. WESTBURY is reviewing some classic models of the past in the light of modern techniques

Continued from 7 March 1957, pages 337 to 339

IN THE ISSUE of February 21, it was stated that an oscillating engine can be made to reverse its direction of rotation simply by changing over its steam and exhaust connections; this applies to all engines timed to work without lap or lead, whether single or double-acting, and with any number of cylinders, with the exception of those having flat slide valves.

It is therefore possible to equip any of these engines with a simple reversing control, consisting of a four-way change-over cock or valve, and such a control is indicated in the plan view of the double engine, Fig. 11. Details of the reversing valve are given in Fig. 12, where it will be seen to consist of two essential parts, a stationary portblock, with four ports and their connecting pipes, and a rotating valve with interrupted annular groove just like the portblock shown in Fig. 9. These parts are lapped to fit truly together and held in friction-tight contact by a spring acting on the centre pivot.

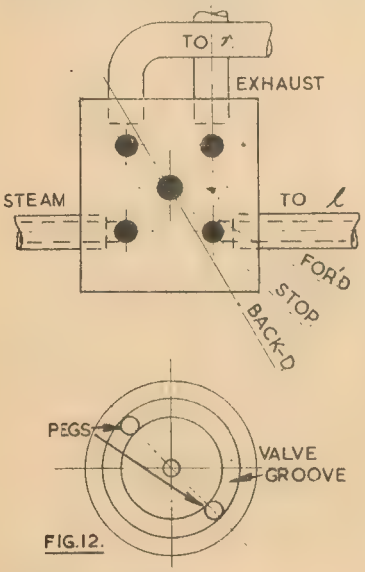


FIG.12.

When the valve is turned into such a position that the blanked portions close two diametrically opposite ports in the block, communication to the cylinders is shut off; this is the "stop" position. By moving it in a clockwise direction, however, steam is admitted to the pipe marked *R*, and exhaust connected to *L*; while moving it the other way reverses these connections. I would suggest, in order to improve the seal of the valve face and make it less critical in angle of movement, that the width of the groove stop should be increased by fitting a peg of larger diameter, or other means.

A VERTICAL BOILER

The boiler recommended for either of these engines is shown in section in the elevation drawing, Fig. 13, and in plan view, Fig. 14. It is preferably made in copper, about 3/64 in. thick, or 18-gauge, for the shell, with end-plates $\frac{1}{16}$ in. thick or 16-gauge, which can be beaten or spun to the shape shown. For relatively low pressures, which should be perfectly satisfactory for these engines, riveting and soft soldering will be safe enough, though as a precaution in case the boiler should ever run dry the joints of the inner flue and cross tubes, which are in contact with the flame, may with advantage be silver soldered.

The flue is $1\frac{1}{4}$ in. dia. by 16-gauge, with cross tubes $\frac{3}{8}$ in. dia. by 20-gauge, and the steam-pipe, which may either be brazed directly into the top of the boiler or fitted with a union joint, is $\frac{3}{16}$ in. dia.

Whatever other fittings are attached to the boiler, a safety-valve must on no account be omitted; this may be of a simple type, combined with the filler plug, as shown in Fig. 15. The boiler should be hydraulic tested to stand 50 p.s.i. without leakage or distortion, and the safety-valve spring (which should be of rustless steel or phosphor-bronze) adjusted so that it lifts at 35 lb. Firing may be by spirit, paraffin or gas, as described in previous articles.

SIMPLE SLIDE-VALVE ENGINES

The majority of steam-engines, large and small, are equipped with slide-valves for the distribution of steam, and of these, the simpler types employ an eccentric (which is essentially a form of crank) for direct operation of the valve in fixed phase relation to the piston stroke.

To anyone who intends to build engineering models of any kind, I consider that a practical understanding of the simple slide-valve engine is essential, and one of the first essays in construction should be devoted to producing a working model of such an engine. Judging by the many queries received on this subject, it would seem that the steam-engine does not receive the attention it deserves in elementary technical

Right, Fig. 11: Plan view of a complete twin-engine plant, showing (top half) crankshaft and (at the bottom) cylinder and the reversing valve

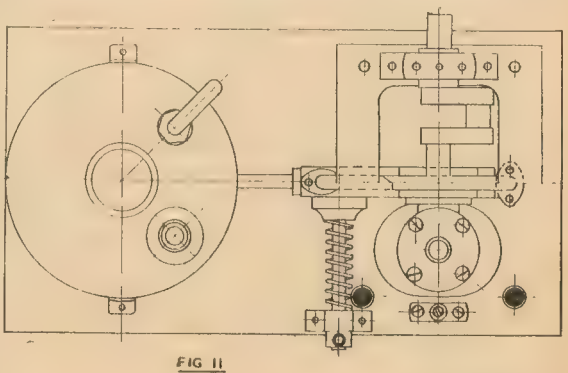


FIG 11

Left, Fig. 12: The portblock and rotating disc of the reversing valve, showing connections to cylinder portblock

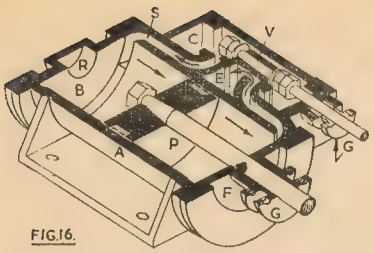


Fig. 16: *Section through cylinder and steam-chest of slide-valve engine*

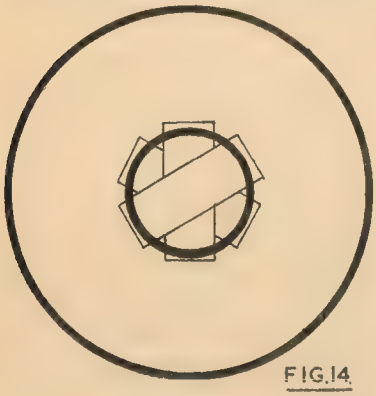
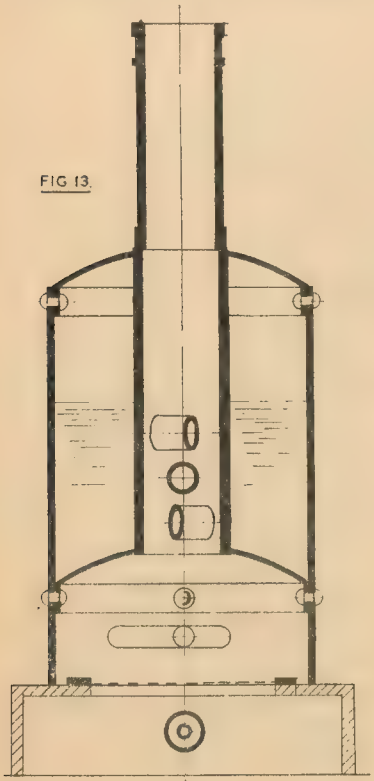


Fig. 14: *Sectional plan of boiler, showing cross-tubes*

Below, Fig. 13: *Section of simple vertical boiler for a twin engine*



education, as many intending constructors do not appear to have mastered its basic principles. I feel sure, therefore, that more experienced hands will not grudge a little space devoted to this important subject.

In my own articles on steam-engines, I have always recommended beginners to start right away on building a slide-valve engine, without worrying about the conventional oscillating engine, which is generally regarded as the first stepping stone to progress in construction.

My reason for this advice is not simply because it is possible to attain higher efficiency with the slide-valve —though this is an undisputed fact —but because the latter gives facilities for the observation of valve events, also for checking and experimenting with timing; in this way it teaches the constructor more about engine functions than is ever possible with an engine in which the means of steam distribution are both invisible and immutable.

When once the principles of the direct-acting slide-valve have been mastered, one can, if one so wishes, go on to study the more complicated valve gears which enable the expansion of steam to be controlled or rotation to be reversed.

Muncaster quite rightly devotes careful attention to the elementary principles of slide-valve operation and gives an isometric section of a steam-engine cylinder and steam-chest which I reproduce here (Fig. 16) to illustrate the essential features. The piston, *P*, is shown at about half stroke, moving in the direction of the arrows, and the slide valve, *V*, is in the appropriate position in relation to it at this stage.

Steam is admitted under pressure to the steam chest, *C*, filling the space around the back of the valve, which has a flat face in contact with a stationary flat surface in which three ports are formed. The two outer ports open into passages, *SS*, leading to the respective ends of the cylinder, and the central port, *E*, is in communication with atmosphere, or the exhaust pipe system.

Both the piston and the slide-valve are connected mechanically to the external working parts by rods which pass through packing glands, *FG*, to avoid leakage of steam at the openings in the cylinder and steamchest.

At the position illustrated, steam is being admitted to the rear or closed end of the cylinder and forcing the piston outwards; the valve meanwhile is moving in the opposite direction, so that it will cut off the steam supply as the piston nears the front end of the cylinder. During this period, the other side of the piston is in communication, through the passage, *S*, and the cavity in the centre of the valve, with the exhaust port, *E*, so that the steam in this space, which has already done its work, is displaced by the piston and is free to escape.

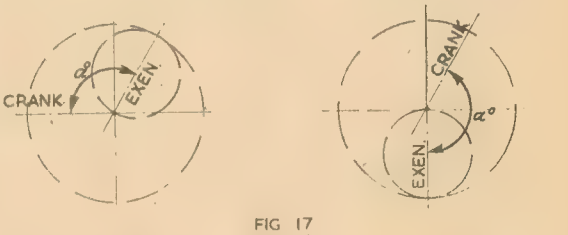
By the time the piston has completed its outward stroke, the slide-valve has moved to commence opening the front end of the cylinder to live steam and the rear end to exhaust, so that the motive force on the piston is reversed and it starts on its return stroke.

An engine of this type is said to be double-acting, as power is applied to the piston on both forward and return strokes; it is the orthodox arrangement for most types of steam-engines, though single-acting engines, in which power is produced on one side of the piston only, are employed for certain duties, particularly where it is desirable to keep the weight of working parts as low as possible for the attainment of high speed.

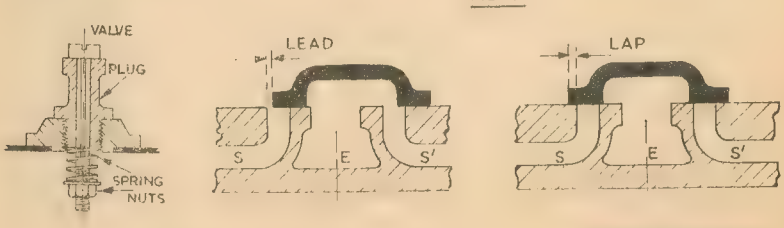
LAP AND LEAD

In early steam engines it was usual to make the closing faces or lips of the slide-valve on either side of the

Right, Fig. 17: *Diagrams illustrating "lap" and "lead," showing corresponding positions of the crank and eccentric (clockwise rotation)*



Below, Fig. 15: *A simple safety-valve*



central cavity exactly the same width as the steam ports they controlled. The valve was timed to move at 90 deg. in advance of the crank, so that the ports commenced to open exactly at dead centres and a full piston stroke was occupied both for steam admission and exhaust.

It was soon found, however, that better working efficiency could be obtained by advancing both the opening and closing points, but not necessarily in the same ratio. Early steam opening could be used to cushion the piston movement, thus bringing it smoothly to rest at the end of its stroke and also to ensure that the maximum effort was available to start it on its return. By cutting off the steam supply before the piston reached the end of its power stroke, the expansive poroperties of the steam could be used to complete the stroke, so that by the time it was released to exhaust most of its energy had been usefully expended.

The means employed to attain this result are by designing and timing the valve to produce what is known as "lap and lead." I have been asked so many times to explain these terms that I consider it worth while to reproduce another of Muncaster's diagrams (Fig. 17) which, in conjunction with the previous drawing, should make them quite clear.

It will be seen that the lips of the valve are extended in width (or, strictly speaking, length, in the direction of travel) so that they overlap the ports, *SS*, when in mid-travel, as seen on the right; the extent of the overlapping is termed "lap." Such a valve, if timed to move at 90 deg. in front of the crank, would give delayed steam opening and thereby reduce efficiency; to compensate this, the timing of the valve is advanced by shifting the eccentric so that it begins to open the steam-port slightly before the crank reaches dead centre; the amount of opening at the latter point, as shown on the left, is known as "lead."

The diagrams above the valve sections in each case show the relative positions of crank and eccentric to produce the required timing; on the left, the crank is on its dead centre and the eccentric approximately 120 deg. in advance of it—in the usual terminology, the "angle of advance" is taken as the amount *extra* to the original 90 deg. in front of the crank, so in this case it would be reckoned as 30 deg. The right-hand diagram shows the eccentric at mid-stroke, still leading the crank by the same amount, of course.

Incidentally, I may mention that in my directions for timing steam-engines in the past I have occasionally been criticised for recommending "rule of thumb" methods—in other words, timing *in situ* by turning the crank to dead centres and checking up on the actual valve position. It might be considered more "scientific" to deal in exact angles of advance, and this would be absolutely necessary in an engine having the eccentrics machined integral with the crank-shaft, or otherwise rigidly pre-located.

But in actual practice the measurement of angles on very small engine components is extremely difficult—one might easily make an error of two or three degrees in the location of a keyway on a small shaft, for instance—and, moreover, it is not always advisable to regard valve setting as being "immutable as the laws of the Medes and Persians."

● *To be continued*

Fig. 18: *Horizontal mill engine to* 1 *in. scale*

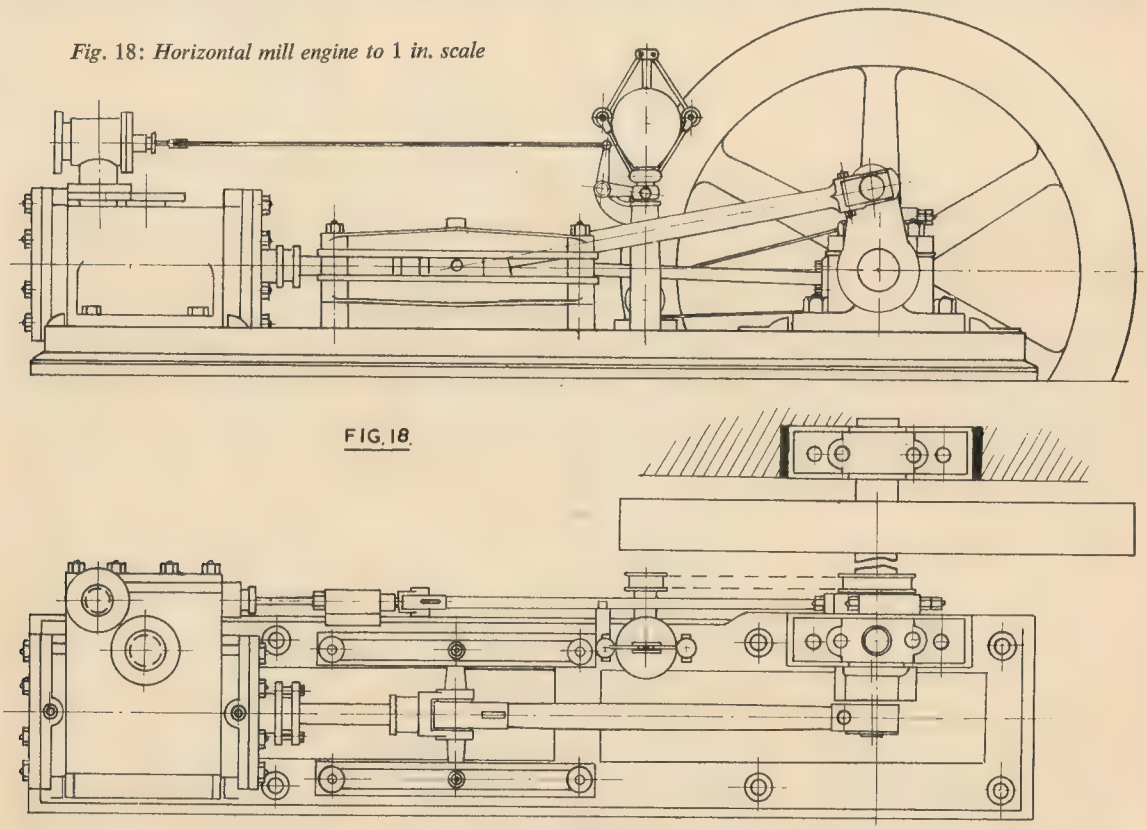
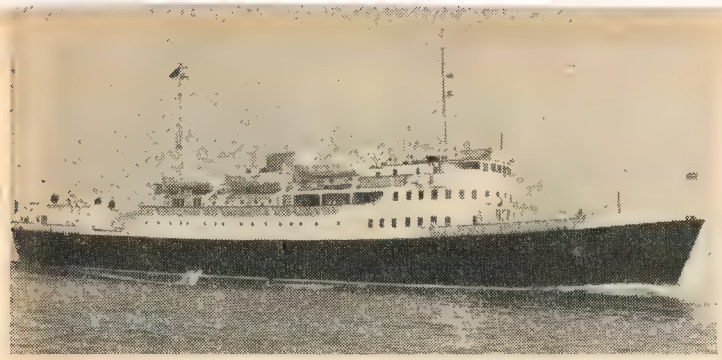


FIG. 18.

WIN A MYFORD SUPER SEVEN LATHE

Readers are reminded that the closing date for the MODEL ENGINEER **competition, the prize for which is a Myford Super Seven lathe, closes on April 5.**



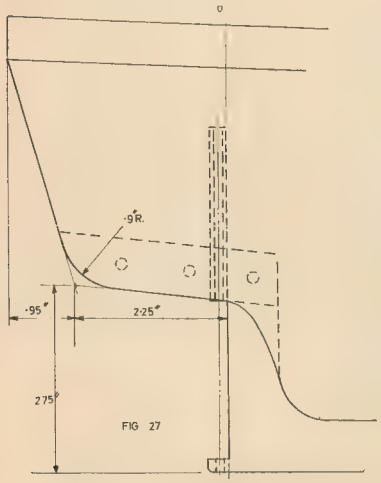
A WORKING MODEL OF ST NINIAN

By EDWARD BOWNESS

Part 6—Which deals with a special deck beam and the after deck

(Continued from 7 March 1957, pages 352—354)

Fig. 27: *Corrected outline of the stern piece*



BEFORE proceeding with the description of the after deck beam at station 3, I must refer back to Fig. 16 [see issue of 21 February 1957, page 275].

The distance between stations 3 and 7 was given erroneously as 20.2 in. It should have been 20.8 in., being four times 5.2 in.—the distance between the stations—and the overall length should be 28.7 in., not 28.1

Now a picture of *St Ninian*—one of a number I have received recently—caused me some perturbation, as it shows an alteration to the outline of the stern.

The hull lines from which I worked and which were supplied by the builders, the Caledon Shipbuilding Co. of Dundee, were faithfully copied in my drawings, as I considered they were more likely to be correct than the general arrangement drawing published in shipbuilding journals. Fig. 27 shows the outlines taken from the general arrangement, which seems to be consistent with the photograph which I have reproduced for comparison.

The length on the L.W.L. and Waterline "d" is increased slightly, but otherwise the lines are not affected. The working drawings issued by the Percival Marshall plans department have now been corrected—both the hull profile and the full-size outline of the stern frame.

DECK BEAM AT STATION 3

In the last instalment reference was made to a deck beam at station 3. In addition to strengthening the hull this beam will support the deck at the after end of the superstructure and will prevent water getting into the hull at this point. A bulkhead would be in the way of the propeller shaft drives from the engine, but the beam proposed will not cause any obstruction.

As will be seen from a study of Fig. 28 the beam consists of a sheet of tinplate flanged all round, fitted and soldered to the inside of the hull for a depth of $1\frac{3}{4}$ in. and flush with

Fig. 28: *Details of the beam under the after deck*

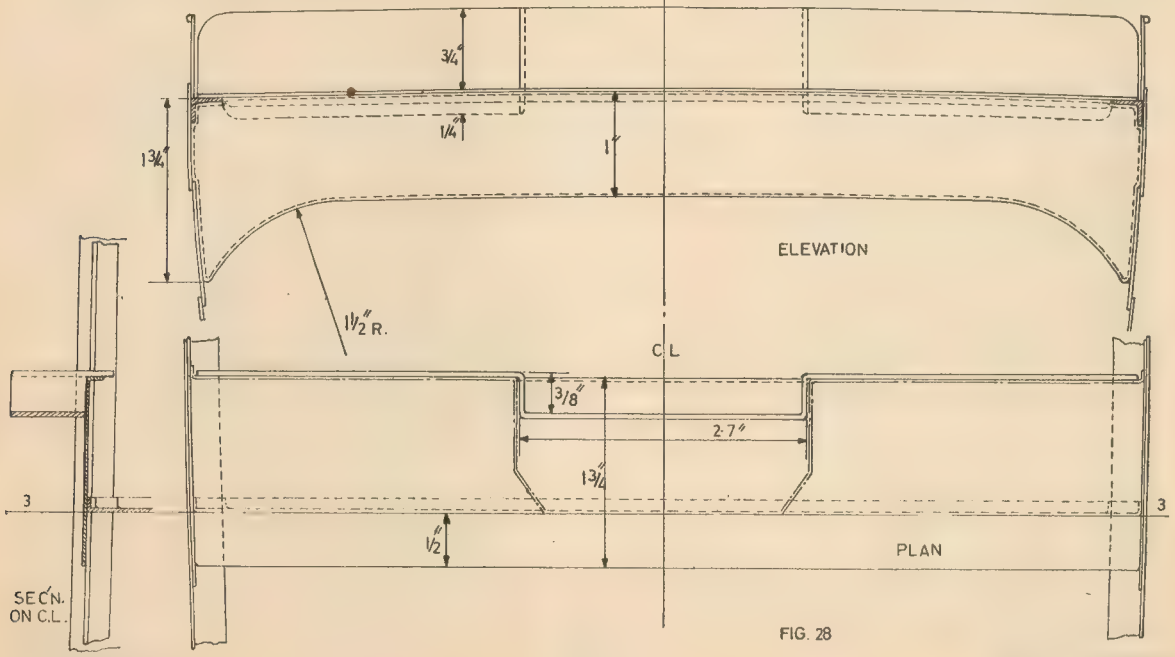


FIG. 28

the top of the side angles. It is arched to suit the camber of the deck, and its depth is 1 in. with flanges $\frac{1}{8}$ in. deep. A plate $1\frac{3}{4}$ in. wide is fitted over this beam and over the side angles, its after edge being $\frac{1}{2}$ in. aft of the bulkhead.

Its forward edge has a flange $\frac{1}{8}$ in. deep against which is fitted the upright strip which locates the superstructure. This upright strip is of heavy tinplate or may be of 20 S.W.G. brass 1 in. wide and about $9\frac{3}{4}$ in. long, being joggled as shown to fit loosely inside the projection on the after end of the superstructure which is found on this deck. The joggled portion is cut away for $\frac{1}{4}$ in. of its depth to overlap the horizontal plate, to which it is firmly soldered all along. It should have a small fillet of solder along its after side to ensure watertightness.

It will, of course, be curved to suit the camber of the deck, which can be checked from the horizontal plate as it lies along the top of the beam. This assembly—the horizontal plate with its upright strip of brass—is then soldered to the side angles and along the deck beam.

It will be seen in Fig. 28 that there is a space of about $\frac{1}{16}$ in. between the ends of the upright strip and the midships bulwark (Fig. 16) which is soldered along the inside of the sheer strake. This is to give clearance for the superstructure, which fits inside the midships bulwark.

Drilling portholes

Before proceeding further the row of portholes in the sheer strake should be drilled. They are $\frac{3}{16}$ in. dia. and are located on a line $\frac{1}{2}$ in. below the upper edge of the sheer strake. This brings them just below and clear of the side angles. This will be an advantage in drilling, as the proximity of the angles will support the plate. If a smaller hole, say $\frac{1}{16}$ in. or 3/32 in. is drilled first, the $\frac{3}{16}$ in. hole can be drilled without difficulty, especially if high speed is used with light pressure. The horizontal spacing should be taken from the profile [see 17 January 1957] pages 96-7 or can be measured directly from the half-size print. A strip of celluloid or perspex should be glued on the inside of the hull behind the ports to simulate glazing and to prevent the ingress of water. In these days of "all-purpose" adhesives it is not difficult to find one to suit. Personally I have had good results from Mixafix a high polymer cement which is made up in two tubes. When a small quantity from each is mixed together they form an adhesive which can be relied on to do the job.

There is a second row of portholes in the hull—just below the rubbing strake from amidships forward. These

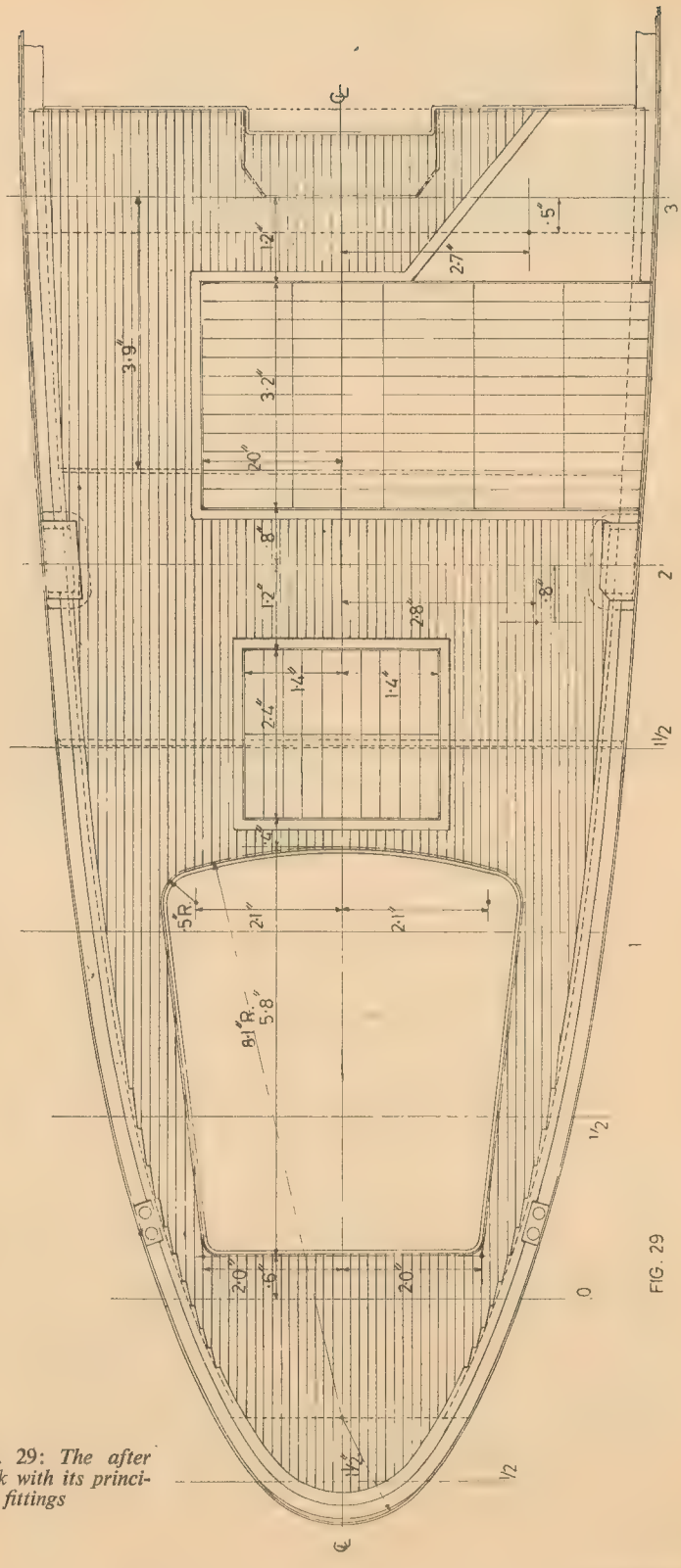


FIG. 29

Fig. 29: The after deck with its principal fittings

Outline of the stern from the quay

are, however, so near the waterline that it would perhaps be better to ignore them.

THE AFTER DECK

Before building the main superstructure amidships it would be advisable to make the after deck and the after deckhouse with the docking bridge. The experience gained in this work will be useful in the more difficult job of making the main superstructure.

I find in making a model which involves a considerable amount of work that by the time I am halfway through I have learnt so much that I want to start again from the beginning. One's technique is improving all the time and it is natural to wish the whole model was made to the improved standard. Therefore, if the simpler jobs are disposed of first, the more difficult ones can be done more successfully later.

Fig. 29 is a plan of the after deck giving dimensions for the principal items. The actual shape should be taken from the hull as already built, allowing about $\frac{1}{8}$ in. overlap along the edge of the side angles and carrying it forward to fit against the upright strip on the deck beam at station 3, which locates the centre superstructure.

Fig. 30: *Sealing flange for after deck house. Fig.* 31: *section of deck showing stiffeners and dummy hatch. Fig.* 22: *dummy vents on after deck*

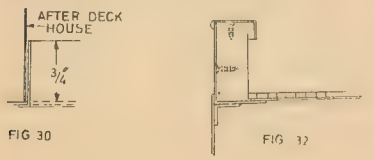


FIG 30

FIG 32

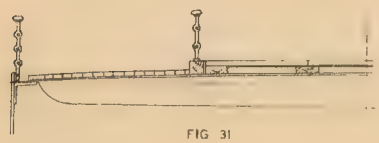


FIG 31

At its extreme after end it rests on the plate which connects the side angles.

The overlap mentioned should leave a space of 0.2 in. between the edge and the inside of the sheer strake. This will represent the waterways which in the actual ship are one foot wide. The edge will be cut away to clear the large fairleads on each side aft, and again to clear the vents from the holds near the after end of the large hatchway.

The dimensions given for the deck house are the figures for the house itself. The deckhouse is removable to give access to the steering and radio gear in the hold below. To keep out water and to ensure that the house is not easily dislodged, a flanged plate is soldered all round the inside of the hole (Fig. 30). The plate is $\frac{3}{4}$ in. high above the deck and has a flange $\frac{1}{8}$ in. wide all round its lower edge. This flange is soldered to the underside of the deck with a fillet of solder in the angle on the upper side. The hole in the deck must be very slightly less all round than the dimensions given and the flange a good fit inside it.

The camber of the deck must be kept in mind all the time when making deckhouses or deck fittings. To help preserve this camber I have shown a stiffener soldered across the deckplate midway between the bulkhead and the deck beam (Fig. 29 and 31). This should be made of 16 S.W.G. brass plate about $\frac{1}{4}$ in. deep in the centre and $\frac{3}{8}$ in. at each end, soldered in the position shown. The length is such that it fits snugly between the two side angles and helps to locate the plate.

Apart from the hole at the deckhouse the deckplate is solid or without holes. The hatches are dummies, as in any working model it is inadvisable to have many openings in the deck. In a working model of a sailing ship I made many years ago I had the normal three hatches, and it sank on more than one occasion owing to the hatches not being tight. One occasion was at the Round Pond, Kensington, and luckily for me, it sank at a place where the water was only three feet deep and I was able to recover it.

In the actual ship the batches have railings all round for the protection of passengers. For our model I have surrounded the hatches with a wooden strip 5/32 in. square, cemented to the deck, with the pillars or stanchions for the railings mounted on it (Fig. 31). Inside this there is a tinplate strip 5/32 in. wide to represent the actual coamings around the hatch. This is soldered to the deck plate. On the forward side of the larger hatch I have taken this strip to the starboard side of the ship where it serves to retain the wooden hatch covers in place. At this point the handrail goes forward at an angle to keep passengers away from the crane which is centred just outside it.

The space inside the tinplate strip is filled with the hatch cover boards, those in the small hatch being laid fore and aft and those in the large hatch athwartship. They are divided as shown on the drawing, and should be supported by a suitable framing of wood, $\frac{3}{8}$ in. or $\frac{1}{2}$ in. wide and 3/32 in. thick.

The boards are of $\frac{1}{16}$ in. sycamore or similar close-grained wood. The sharp edges should be removed from the upper surface of the boards—but only just !—so that the joints are visible when they are all packed in position. Imperceptible joints with a smooth finish would be inappropriate. The boards should be glued in position permanently.

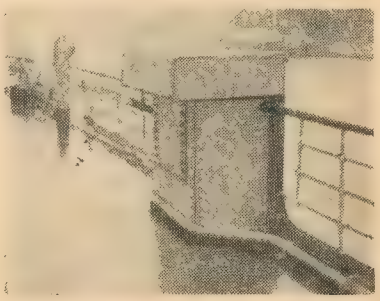
In the larger of the two hatches the row of boards nearest the starboard side are fitted against the inside of the sheer strake. The deckplate should be extended for the width of this hatch to support the boards when it is being lifted off.

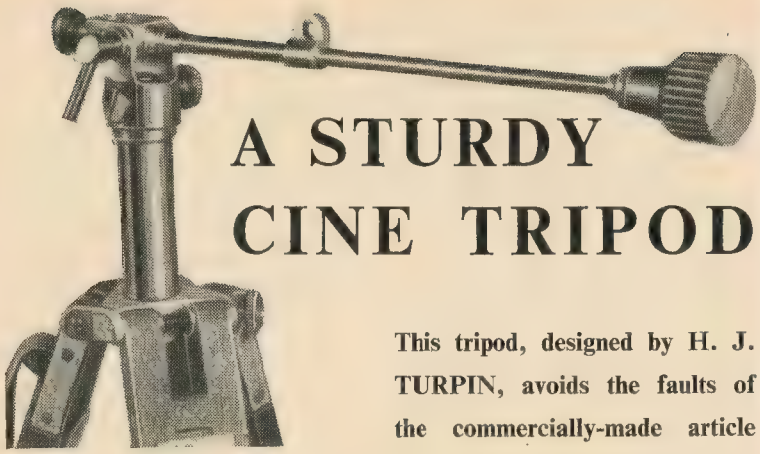
Double doors are provided in the side of the ship where the hatch is extended to the starboard sheer strake. These are 12 ft wide and extend down to the level of the 'tween deck. There is a similar pair of doors 8 ft wide exactly opposite, in the port side of the ship. These are to facilitate the handling of cattle and sheep, the transportation of which is an important feature of the Orkney and Shetland traffic.

These doors fit snugly in the sides of the ship and should be indicated by a line scribed on the sides of the hull. The starboard doors are shown on the general arrangement drawing; the port doors are similar but narrower. When scribing the lines be sure not to use too sharp a point, as the intention is merely to indent the plates and not to cut them. The hinges and fastenings are not very noticeable in the actual ship and could well be omitted from the model.

● *To be continued.*

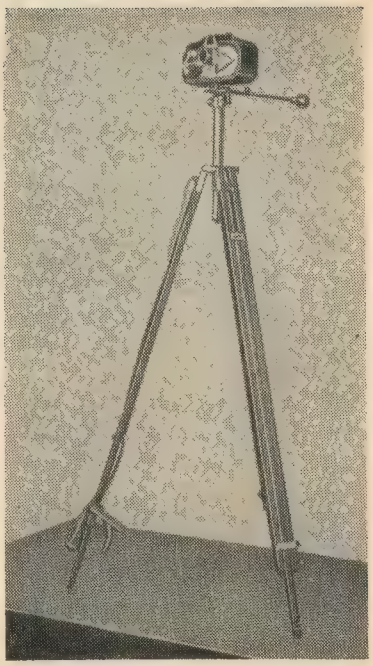
Ventilator from the hold on the port side of the ship





A STURDY CINE TRIPOD

This tripod, designed by H. J. TURPIN, avoids the faults of the commercially-made article



FOR 8 mm. filming it is essential to use a tripod or other means of support where possible. Nevertheless, for a photographer to be seen carrying one, let alone using one, today is most unusual.

I have learned the lesson of picture steadiness the hard way and now never hesitate to use a tripod wherever the occasion demands. There were three reasons which led to the development of the model described here.

First a $\frac{1}{4}$ in. Whit. female thread is the British Standard means of attaching a camera to a tripod. Either the camera or the tripod has to be rotated with the constant fear of dropping the camera; moreover it produces excessive wear of the camera thread.

Although my camera is in the expensive class its $\frac{1}{4}$ in. Whit. thread is tapped into the zinc alloy body and in a 400 ft film taken two years ago the camera was screwed to the tripod about 100 times. The resultant wear on the camera thread was alarming.

Second, cheap, multi-sectioned tripods are useless for cine work. The real steady ones are heavy and expensive, and to these have to be added the expense of a pan and tilt head.

Third, commercial tripods nearly always seem those few inches too low.

Principles of the new design

The camera is offered to the tripod in a vertical aspect only, and secured by the turn of a thumbscrew. By this means one never loses one's grip on the camera.

The overall length of the folded tripod is 2 ft 6 in. It weighs $2\frac{1}{2}$ lb. and is carried by a fabric sling from the shoulder.

It has two extensions; the first one is in the legs which extend in one section only, the second is a central tube unit which can raise the camera a further 6 in. When the tripod is fully extended the base of the camera is 58 in. from the ground.

Although really good workmanship is required for the central tube unit, the whole tripod is well within the ability of a model engineer.

CONSTRUCTION

The first thing to do is to make an adapter, *B*, Fig. 1. This has a $\frac{1}{4}$ in. Whit. screw cut specially to fit the thread in the camera body, *A*. Below that is a flange and then a spigot 0.5 in. dia. × 0.5 in. long, which drops into the tilting member, *C*.

This adapter should be screwed permanently into the camera body and could be prevented from rotating by a 10 B.A. screw through the flange, but I have not found this necessary. So the adapter is now a permanent part of the camera.

A $\frac{1}{4}$ in. Whit. tapped hole in the spigot serves as a means of securing the camera to the ever-ready case, the tilter or any other appliance, and the camera never has to be rotated.

Tilting member, *C*, is pivoted on $\frac{1}{4}$ in. dia. clamping screw, *F*, in the panning member, *E*. A steel shim, *M*, 0.5 in. dia. × 0.005 in. thick is inserted each side of *C* and makes for smooth movement during rotation. It is essential that these items should fit without shake before turning the clamp, *F*.

Panning handle, *P*, 9 in. long, with plastic knob, *O*, and two ferrules, *N*, is shown in the operating position. When not in use it is screwed into the spigot, *Q*, to form a prolongation of the tube, *L*. It fits snugly within the three legs when folded. The item, *R*, is a 6 B.A. stopscrew to prevent complete withdrawal of the tube from the leg unit. Panning member, *E*, revolves around a grooved spigot, *K*, fitted to the top end of the tube.

Satisfactory panning is not easy to achieve. If the pivot is entirely free then one has very little control. If it is tight then the movement traverses in jerks. A mean condition which has given every satisfaction is the fitting of a spring loaded pressure pad, *H*, held in by a screw, *J*, threaded $\frac{3}{8}$ in. × 32 t.p.i. This pad exerts just sufficient continuous friction to ensure a light uniform resistance when panning.

Materials used were: stainless steel for items *B*, *D*, *F*, *G*, *J*, *N*, *P*; mild steel, *K*, *M*; plastic, *O*; brass, *H*; brass, chrome plated, *L*, *Q*, *R*; hard aluminium alloy, *C*, *E*.

LEGS UNIT

All the main features of the tripod meet at the hub, *A*, Fig. 2, which receives the tube unit in the $\frac{3}{4}$ in. dia. central hole, and the three leg units in the gaps, *B*. The tube unit has a vertical travel of 6 in. and this produces a dangerous condition, when fully extended, e.g., the whole unit with the camera could drop that distance suddenly if the clamp screw, *D*, were inadvertently released.

To prevent this a spring-loaded pressure pad, *C*, similar to that used for panning, is fitted and applies continuous friction on the tube in any position. Locking of the tube is by the thumbscrew, *D*, which requires but half a turn to make contact with *C*.

Each leg is made from three lengths of $\frac{1}{2}$ in. square mahogany, the outer two, forming a unit, being coupled together permanently at the top end

by a distance piece, *E*, and No 6, 1¼ in. brass screw, and at the bottom by a 20-gauge stirrup clamp, *F*. The clamp screw, *G*, is turned from $\frac{3}{16}$ in. bar, screwed 2 B.A., and it functions in a ½ in. square nut, *Q*, 5/32 in. thick.

The main joint to the hub is all important to obtain rigidity. Each of the outer members is recessed to receive 18-gauge wearing plates, *H*, such that the width over the plates when assembled is a push fit in the 1½ in. gap, and can rotate without shake on a 5/32 in. axis pin, *J*.

Although the flexing of a ½ in. square member is exceedingly small an outward pressure is exerted on the joint by the spring, *K*, through a washer at each end. It is to ensure that the good fit in the 1½ in. width is maintained. Rod pin, *J*, is a tight fit in the lugs of the hub and is prevented from rotating by a 10 B.A. screw, *L*. The single inner leg is controlled in the outer members by the clamp, *F*, and a pair of 18-gauge plates, *M*.

Provision for a ¾ in. fabric sling is made on one leg only, to which are screwed two brackets, *N*, and *O*, 18-gauge thick. Bracket, *N*, lies flat upon the outer members, while *O* has to be shaped to allow the guide plates, *M*, to pass underneath. The two fixing screws pass through the ½ in. leather binding strap, *P*, and elongated holes in the flange of bracket, *O*. These are to allow a certain small movement of the outer members when the clamp screw, *G*, is operated.

A wax floor polish should be thoroughly rubbed into the woodwork to ensure free running and to enhance its appearance.

Materials used were: stainless steel for items, *D*, *J*; mild steel, *G*, *L*, *N*, *O*, *Q*; spring steel, *K*; leather, *P*; brass, *C*; brass, chrome plated, *F*, *H*; hard aluminium alloy, *A*, *M*.

This tripod is very efficient, and although the actions of panning and tilting in cinematography are to be discouraged it will be found that the movements allowed for in this design permit the photographer to get very quickly and easily on to his target. ▣

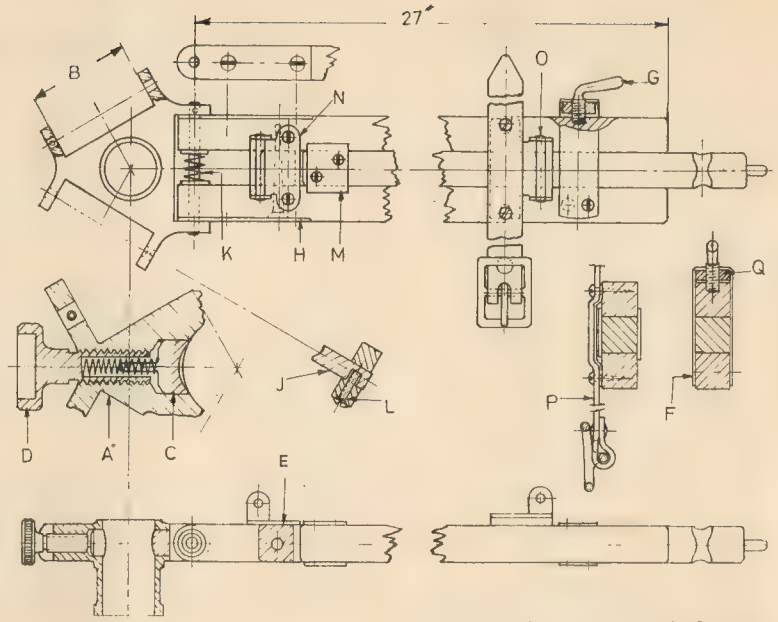
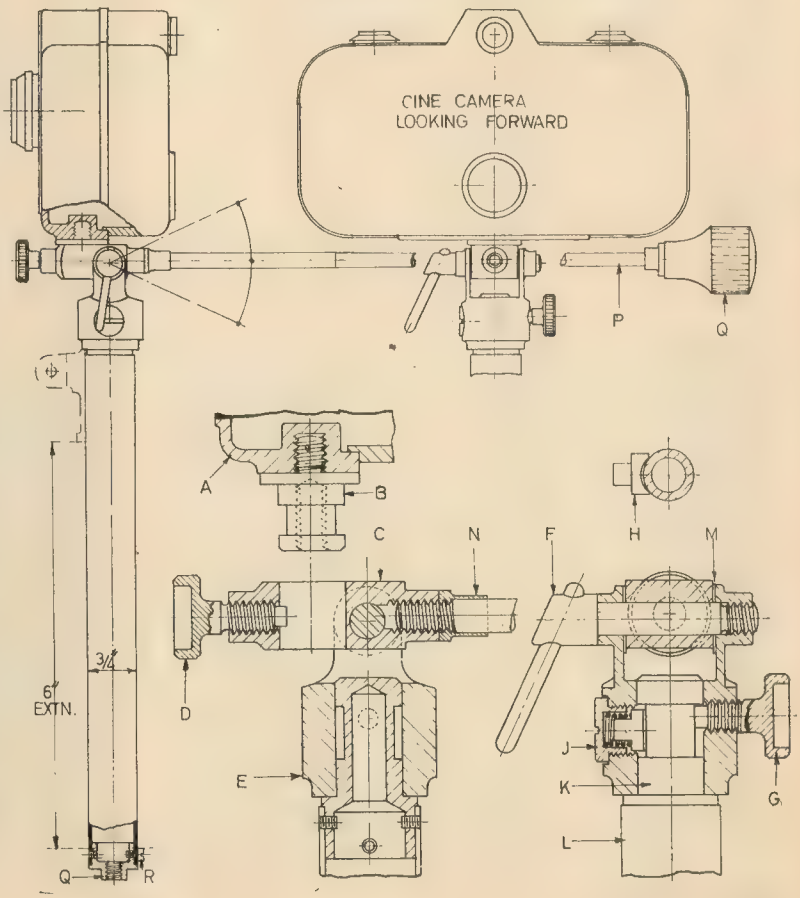


Fig. 2: Details of the tripod's legs unit

Fig. 1: Method of constructing and assembly of the tube unit



FITTING BEARINGS

Plain, ball and roller bearings are described fully in *Bearings and How to Fit Them* by Ian Bradley and Norman Hallows.

The authors give details of the best materials and methods for constructing bearings, and describe their various applications, particularly with regard to the small workshop.

The book is obtainable from Percival Marshall and Co. Ltd, 19-20, Noel Street, W.1, price 3s. 9d. post paid (U.S.A. and Canada $1.00).

A high-pressure WATER GAUGE

R. D. RICHARDS describes a model which may be utilised as a basis for smaller, more elegant efforts

With the progressive increase in steam-plant working pressures, particularly for power stations, the problem of providing a reliable means of indicating the working water level in the boiler arose. Glass-tube water gauges which were suitable for low and medium pressures were found to be inadequate for high-pressure work and lacking in resistance to the erosion associated with high-operating temperatures.

To overcome these difficulties the glass-tube gauge was replaced by a hollow metal body having plate-glass windows secured at front and rear by means of clamps—a design which retained the necessary feature of providing visual means of checking the water level. The toughened glass windows were protected against erosion by the introduction of mica strips on the steam side.

Both the mica and the glasses overlapped the aperture in the body and were rendered pressure-tight by the use of a suitable material in gasket form, such as compressed, graphited, asbestos fibre. It will be seen that a narrow vertical gap between the clamps allows natural or artificial light to illuminate the liquid level, the general practice being to employ an electric lamp at the rear of the gauge which throws the meniscus into clear relief.

On boilers with high steam drums reflecting mirrors on the gauge and at firing-floor level are used—periscope fashion—to bring the illuminated image down to eye level.

The model gauge described is based upon the foregoing design and was made for a water-tube boiler. It embodies the robustness, large water area and efficiency of the prototype, but to achieve these features it was found impossible—as often is the case with miniature gauges—to work to scale.

Influencing the design to a great extent was the necessity in this case of maintaining between steam and water connections a centre distance of two and a quarter inches. Fig. 1 shows the arrangement of one gauge although in fact there are two—left- and right-hand—mounted, one on each side of a central-gauge column which incorporates the steam and water valves (Fig. 9).

In full size the body is made of steel, but brass or gunmetal will suffice for models, provided the pressures involved do not exceed 250 p.s.i. nor the temperatures exceed 405 deg. F.

THE BODY

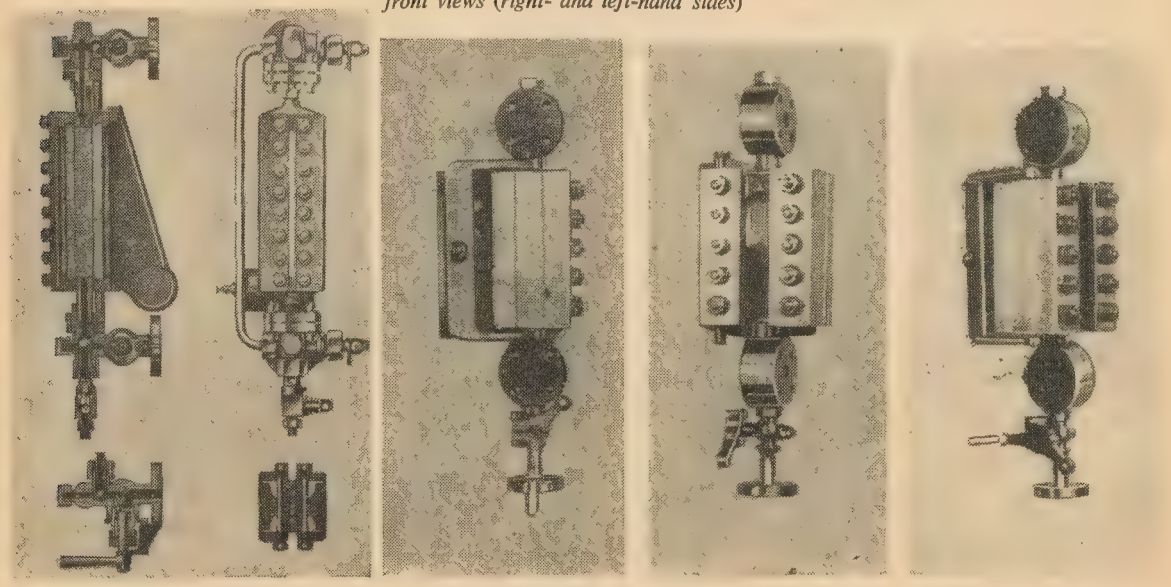
The body is a piece of gunmetal $1\frac{3}{8}$ in. long, 1 in. by $\frac{1}{4}$ in. section (Fig. 2*A*). Symmetrically about the scribed centre lines on both faces the $\frac{7}{8}$ in. aperture is cut out, as are the $\frac{1}{2}$ in. wide $\frac{1}{16}$ in. deep recesses at the top and bottom. An axial hole is drilled No 40 and counterbored $\frac{3}{16}$ in. dia. at each end for the main flange nipples, which are pressed into place and silver-soldered.

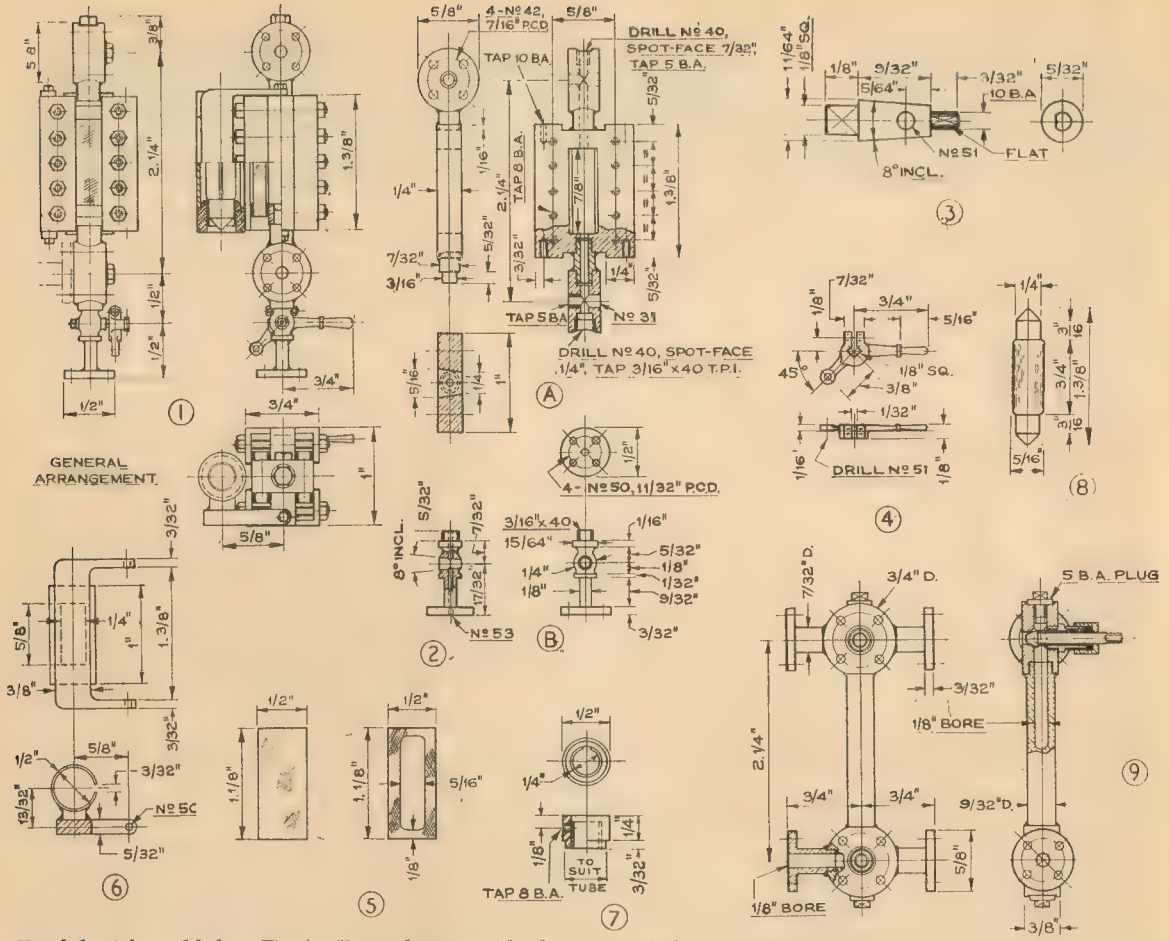
The faces are made dead flat by draw-filing and using successively finer grades of emery cloth laid on plate glass. Tapped in the shoulders are 4-10 B.A. blind holes for screwing the lamp bracket in position—either left or right hand as convenient.

A piece of $\frac{5}{16}$ in. × $\frac{5}{16}$ in. × $\frac{1}{16}$ in. brass angle is used to jig-drill five No| 51 holes on each side of the aperture at 17/64 in. centres prior to tapping them 8 B.A. In this operation the jig is clipped to the body with the undrilled leg abutting the edge it overlaps.

The front clamps of $\frac{3}{8}$ in. × $\frac{3}{8}$ in. × $\frac{1}{16}$ in. brass angle are drilled with the aid of the jig which, in this case, is placed inside the vee of the clamps. Next, the rear clamps are jig-drilled, using their front counterparts clipped to them face to face to ensure matched

Left: Arrangement of a high-pressure water level gauge
Below left, centre and right: Side view and three-quarter front views (right- and left-hand sides)





Top left, right and below, Fig. 1: Front elevation, side elevation and plan. Top left, right and bottom left, Fig. 2A: Side elevation, front elevation and section. Top right, bottom left and right, Fig. 2B: Flange drilling, side elevation and front elevation. Fig. 3: Drain-cock plug and washer. Fig. 4: Handle for drain cock. Fig. 5: Sight glass and gasket. Fig. 6: Lamp housing with mounting bracket. Fig. 7: Ebonite plug for lamp housing. Fig. 9: Central column with shut-off valves

pairs per set of studs. All the clamp-stud holes are then opened out with a No 42 drill and the side legs are shortened to about ¼ in. length. The exact dimension can be found by adding to the glass thickness twice the thickness of the graphited asbestos gaskets to be used. (Mica may be dispensed with in a model.)

Two brass nipples, tightly fitting the $\frac{3}{16}$ in. counterbores in both body and main flanges, are pressed home; maintain these parts in the correct relative position for silver-soldering. and note that the flanges may face front or right or left according to requirements.

Ten gunmetal clamping studs 1 in. long project $\frac{3}{8}$ in. from both faces of the body and these may be fixed in this position only after a trial fitting of all the parts has proved satisfactory. This is done by sweating, a tiny bead of solder only being required.

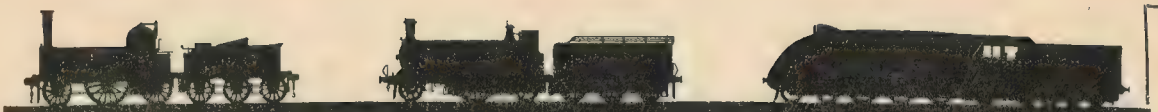
THE TURNING

Special care in marking out and cross-drilling the main flanges is necessary to ensure alignment of the gauge on assembly. Gunmetal rod is used, $\frac{5}{8}$ in. dia., being faced, centred, drilled, tapped 5 B.A., counterbored No 31 and parted off in slices $\frac{5}{16}$ in. thick. Midway between faces, centre and drill No 40 a radial hole; counterbore $\frac{3}{16}$ in. dia. to $\frac{3}{16}$ in. depth from one side. The opposite end of this hole is spot-faced 7/32 in. dia. and tapped 5 B.A. for the top flange, but spot-faced ¼ in. and tapped $\frac{3}{16}$ in. × 40 × 5/32 in. deep for the bottom flange.

Drill the flange bolt-holes, 4 No 42, by aid of a brass jig recessed $\frac{5}{8}$ in. dia. to fit snugly, cap fashion, over the flanges. The p.c.d. is $\frac{7}{16}$ in. The holes must be equally spaced and symmetrical about the radial cross-holes mentioned otherwise there is a danger of breaking through into these. Hexagon-head cleaning plugs with 5 B.A. threads and 1/64 in. asbestos washers are fitted as indicated in Fig. 1.

Two methods can be employed for making the drain cock, which may be turned integral with the drain flange and its branch; an easy way out is to use a commercial loco-type cylinder drain cock. This is counterbored to a depth of about $\frac{1}{16}$ in. at the snout to take a spigot-ended branch with flange, pressed home and retained by a little fillet of soft solder. An advantage possessed by the latter method lies in the fact that drilling the ½ in. flange is rendered easier. Four No 50 bolt-holes for 10 B.A. bolts are located off centres—with respect to the axis of the tapered plug—on a p.c.d. of 11/32 in. with provision for the attachment of a drain pipe (Fig. 2*B*).

● *Continued on page 446*



LOCOMOTIVES I HAVE KNOWN

WHEN article No 17 of this series had been published one or two older readers promptly reminded me that no drawing of a Brighton B2 class engine with tender had ever been published. Thus could I do something about it ?

The B4 class, dealt with in article 17, was directly derived from the B2s which had been put to work in 1895 and were very well known to me, so, having made the necessary drawing, I can repair the omission.

The B2 class engines were designed by Robert J. Billinton as his first express passenger engines for the L.B.S.C.R. They were also the first 4-4-0 tender engines that the old line possessed, and were quite a new departure for the Brighton.

They were graceful, slender-looking engines—which is really about all that can be said in their favour. Not that they were wholly bad, but their work was never outstanding. They were not particularly vigorous pullers and they seemed to have difficulty in getting a move on, as we say today.

The rather small boiler, combined with the four big coupled wheels produced an effect that suggested grasshoppers, and to the men—and many other people besides—the engines were known as " Grasshoppers " ever afterwards. In addition the prominent exposure of the big driving wheels was regarded at the time as rather overstepping the bounds of decorum !

The design was prepared in 1893 and, be it said, included a *smaller* boiler ! It was subsequently much improved and the first three engines, Nos 314, *Charles C. Macrea*, 315, *Duncannon* and 316, *Goldsmid*, were put to work in June 1895. Exactly 12 months later the first of 21 further engines of the class came out, the last one being put to work in January, 1898. They were intended to replace the valiant little Stroudley single-wheelers on the Portsmouth line, but did not entirely succeed in this project, as some of the singlewheelers managed to hold their own against the newcomers for nearly 12 years afterwards.

I have drawn *Goldsmid* in her original condition; she was later fitted with the automatic vacuum brake in addition to the standard Westinghouse air brake, and it entailed some extra piping which did not improve her appearance. No 202, *Trevithick*, No 206, *Smeaton* and No 208 *Abercorn* were fitted in 1901 for burning oil fuel on Holden's system which was so successful on many Great Eastern Railway locomotives at that time.

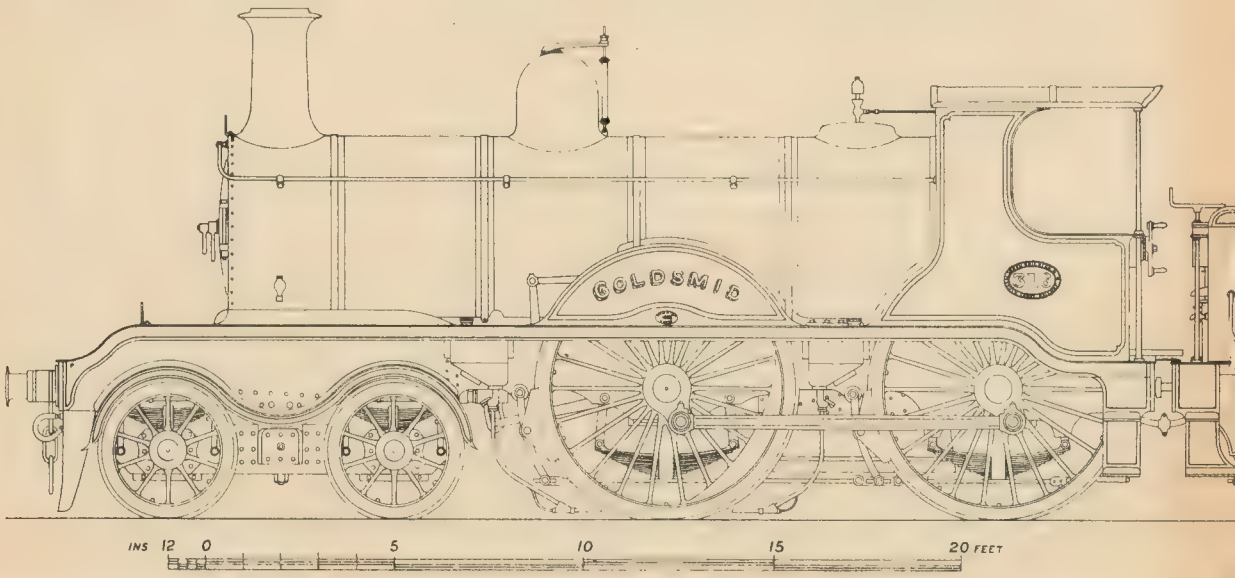
No 206 was also noteworthy for two other events in her career; on 2 October 1898, she worked the first 60-minute all-Pullman train from Victoria to Brighton, while on 24 December 1900 she was at the head of the express which, during thick fog, came into violent collision with a train that was standing on the same track in Wivelsfield station, causing some deaths and many injuries to passengers.

Sound effects

From about 1906 Mr D. E. Marsh turned his attention to these engines and in the endeavour to improve their performance he gradually fitted the whole lot with much larger boilers. This, however, achieved only partial success and nothing like the general improvement that had been expected; that suggests that the fundamental trouble was in the engine rather than in the boiler.

I can never forget the wonderful musical ringing given out by the coupling-rods when these engines were running; it was a characteristic of all the Billinton 4-4-0s, but was for some reason especially noticeable in the B2s. It inspired my boyish efforts as a mimic of loco noises, and was not very difficult for me to imitate.

It is strange how from time to time a locomotive engineer has seemed to lose his courage temporarily. R. J.



L.B.S.C.R. 4-4-0 No 316 GOLDSMID

No 29 By J. N. MASKELYNE

One of a class known as 'Grasshoppers' . . .

Billinton was one of these; he had been under Stroudley at Brighton years before and then moved to the Derby Works of the Midland Railway as chief draughtsman under S. W. Johnson. Therefore, he must have been familiar with the general trends of locomotive design at that time. Yet when he returned to Brighton to become locomotive superintendent and found that there was a need for a new class of express passenger engines to follow on his predecessor's Gladstone class, he produced a design which at first was about 10 years out of date. He then modified the design, bringing it only just into line with contemporary practice before building the first of the new engines.

His ideas changed quickly, however, because in only four years his basic 4-4-0 engine became transformed from the none-too-successful B2 class into the magnificent B4 class, of which No 70, *Holyrood*, described in article No 17, was one. The intermediate B3 class of January 1898 consisted of only one engine, No 213, *Bessemer*, which was merely a B2 with a slightly larger boiler. She was a successful engine, but she showed quite clearly that a larger boiler was not all that was required.

The B2 class engines may not have merited a place among England's best 4-4-0s, but I had a great affection for their pleasing, graceful lines and their attractive variety of noises.

Their principal dimensions were: cylinders, 18 in. × 26 in., inclined at 1 in 20; the diameters of the wheels were 3 ft 6 in. for the bogie and 6 ft 9 in. for the four coupled wheels; the wheelbase was 6 ft plus 7 ft 2 in. plus 10 ft 9 in., totalling 23 ft 11 in.

The boiler was made in three rings, the largest of which was 4 ft 5 in. dia. outside; the length of the barrel was 10 ft. 7¼ in. between tubeplates and the pitch was 7 ft 7 in. above rail level. The firebox casing was 6 ft 2¼ in. long and 4 ft 1 in. wide, and the depth was 5 ft 3 in. in front and 4 ft 9 in. at the back. There were 267 tubes of 1⅝ in. dia., the heating surface of which was 1,227.34 sq. ft. The firebox heating surface was 114.74 sq. ft, making the total 1,342.08 sq. ft. The grate area was 18.73 sq. ft.

Weights and dimensions

The weight of the engine in working order was 42 tons 16 cwt, of which 28 tons 16 cwt rested on the coupled wheels. The tender wheels were 4 ft dia. and the wheelbase 13 ft equally divided, the overhang at the leading end being 4 ft 4 in. and at the back 3 ft 10½ in. The capacity was for four tons of coal and for the first three engines 2,420 gallons of water which, on the later engines was increased to 2,600 gallons.

The position of the reversing screw beyond the cab pillar applied to the first three engines only; on all the others it was 6 in. farther forward.

In all my long association with the model locomotive hobby I have never seen a model of one of these quite attractive-looking 4-4-0s. I have sometimes wondered why. There is no insurmountable difficulty to be tackled, and a model in any size from 3½ in. gauge upwards could be made to give at least as good a performance as can be obtained from many a less attractive engine of the 4-4-0 type.

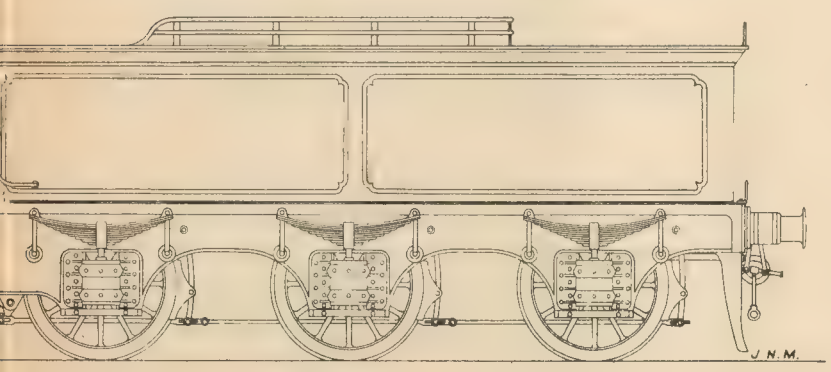
For those who believe that the small boiler could not be made to give the required amount of steam, the Marsh rebuild with a 5 ft dia. boiler offers a possible alternative, with the added advantage of greater weight for adhesion. Perhaps, somebody may try either, or both, some day.

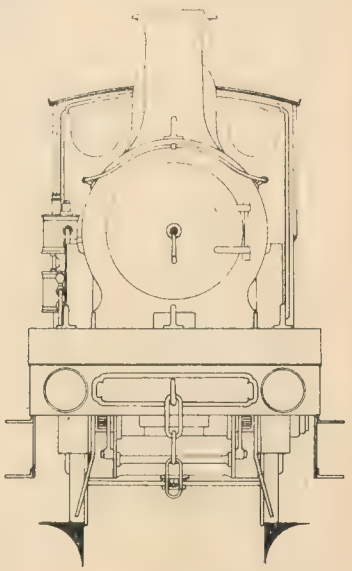
One of the tricky details to reproduce in a model would be the fitting of the chimney. In the prototype, the bottom flange fitted down flush with the smokebox wrapper plate. This was due to the fact that the smokebox was actually double, with a thickness of lagging between the inner and outer plates. The chimney, therefore, stood on the inner plate and projected through a hole cut in the outer plate.

So neatly was this done that I never saw a suspicion of a misfit between smokebox and chimney.

This method of fixing the chimney was used on all the Billinton engines of the L.B.S.C.R. in the early 1900s and it fascinated many people. To achieve it nicely in a model calls for some careful fitting but I think it could be managed without going to the trouble of making a double smokebox.

The smokebox could be made in the usual manner and a hole cut in the upper part to take the base of the chimney. The latter could rest on a ring silver soldered to the inner surface of the wrapper-plate. The ring itself could be part of a petticoat-pipe. ▣





A SUCTION FAN FOR STEAM RAISING

L.B.S.C. details a simple method for "raising the wind"

—★—

WHEN I first started operations with old *Ayesha* soon after the Kaiser's war—that's a long time ago, isn't it?—I used two methods of making a draught to light the fire. One was to disconnect the hand-feed pipe and connect a tyre pump to the union by an adaptor, blow air into the boiler and use the engine's own blower until she made enough steam to do her own blowing (as mentioned in the *Virginia* notes); the other was to use an extension chimney with a blower jet in it, which was fed with steam from an old "pot" boiler heated by our domestic primus stove.

This was the handiest, as it left both hands free to attend to the fire and to oil up. Later on I acquired a little air compressor and I fixed up a motor to drive it; this took the place of the primus-fired boiler as it was ready for use at a minute's notice; what British Railways call "maximum availability." The compressor outfit was mounted on a board with an air tank consisting of a big preserved-fruit can, the extension-chimney-blower being connected by a rubber pipe, so it was very portable.

This bag of tricks gave every satisfaction and I used it for many years. Then one fine day the late and very much lamented foundryman, Harry Sturla, came to see me and brought a friend, Mr A. C. Barltrop, to try his engine over my line. The latter brought his own steam-raising gadget, which consisted of a suction fan directly connected to a little motor.

The funnel under the fan was pushed into the engine's chimney and when the "juice" was switched on, the fan promptly performed the vacuum-cleaner act, sucking air through the firebox and making the fire roar away like a gauge "O" lion. I was tickled to death with it as it was much lighter than my outfit but just as effective; and when Mr Barltrop, noticing my approval, asked me if I would like a similar one you can bet your sweet life that I didn't hesistate in saying "Yes, please!"

Within a few days I received the new steam-raiser and immediately fitted a three-pin plug to it; I also made a set of adaptors to allow it to be used on the varying diameters of my locomotive chimneys. It went into service at once, gave every satisfaction and my compressor came in handy for other duties, such as trying the "works" of a locomotive by air pressure before erecting the boiler.

Unexpected trouble!

But there was a cloud on the horizon. The little motor was wound for 240 v. and our line pressure was only 205, so it never attained full speed. The district in which I live was rapidly developing, more houses being erected, all taking current from our feeder cables, and the line pressure dropped lower and lower until sometimes it was only 170 v. or thereabouts, and the little motor would hardly drive the fan.

I was just about to revert to my compressor blower when I remembered that I had a 200 v. motor which once belonged to a table fan, and I wondered if it would drive the suction fan at the desired speed; so I gave it a good clean and overhaul, and fitted it to the fan. It worked fine, creating plenty of draught even at the minimum voltage. It is still in use.

Some years ago the electricity authority put in a new sub-station and additional feeder cables and raised our line pressure to a nominal 240 v., though it usually averages about 230, but as the fan-motor can use this pressure (it is rated 200-230) it makes the fan step lively and draw up the fire like nobody's business.

How to make the fan

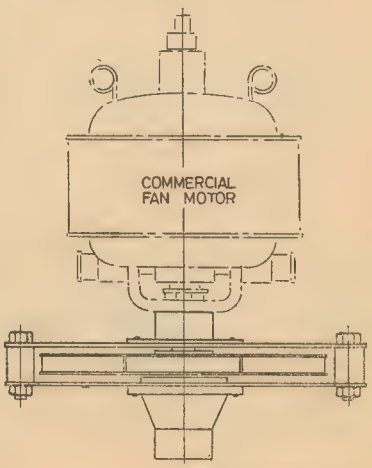
From time to time I receive queries about getting up steam in a locomotive boiler (usually from newcomers to our craft who haven't learned all the tricks of the trade) and just recently a friend who had been using a discarded vacuum-cleaner to draw up his fire wrote me that this had gone on strike, and could he purchase a suction fan to replace it; if so, what firm. I made one for him, and while doing so I thought it would be a good opportunity to offer a short description of how to do it.

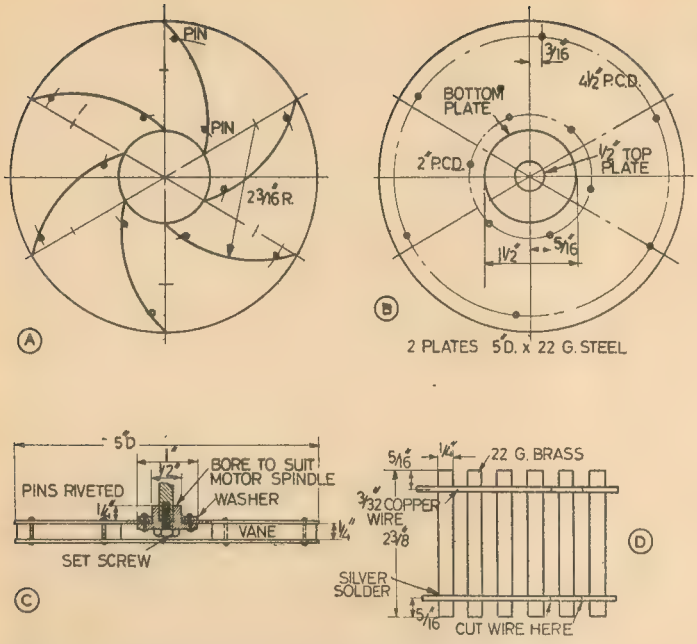
In the recipe for jugged hare in my mum's cookery book it said "first catch your hare"—maybe the writer was a poacher—likewise, first get your motor. I *could* describe how to make one but small fan motors are commercially obtainable at a reasonable rate even if new, and used ones can probably be purchased from electrical advertisers.

If the steam-raiser is needed for outdoor use, where no supply is available from a power line, a battery motor can be used equally well. The one I used is a standard type, with a boss for the bearing at each end of the casing, and I adapted the fan to fit over one of the bosses. Some of these small motors have a flange at one end of the casing and the top plate of the stator, or fan frame, could be attached to this direct by bolts.

The stator consists of two circular plates 6¼ in. dia. cut from 16- or 18-gauge sheet steel. I marked mine out and rough-cut them on my Diacro shearing machine, then drilled a ½ in. hole in the middle of each,

The general arrangement





Details of assembly: (*a*) *bottom rotor plate with vanes assembled*; (*b*) *method of drilling rotor or fan plates*; (*c*) *rotor or fan assembled*; (*d*) *how to attach the pins to the vanes*

clamped them together between two nuts on a ½ in. bolt, gripped the bolt in the three-jaw, and turned the edges to size, which makes a nice finish.

While still clamped together, the four holes were drilled for the $\frac{3}{16}$ in. bolts which hold the two plates together. After separating, one of the plates was chucked in the big three-jaw and the hole in the middle bored out to 1½ in. dia. to take the suction funnel.

SPINNING-JENNY

The two plates for the rotor were cut out, clamped together, and trued up in a similar manner to the frame plates, using 22-gauge material, as the rotor should be light. Aluminium could be used if available; the less weight, the less chance of vibration.

Now be careful about the marking-out. I divided the circumference of the plate, with the larger hole in the middle, into six parts by laying it on the bench, setting my dividers with the points a full 2½ in. apart and stepping off the divisions with one point of the dividers just sticking in the bench, close to the edge of the plate, while the other point made a mark on the edge of the plate.

A steel rule was then laid across the plate, with the edge lining up with the diametrically-opposite markings, and lines were scribed right across, as shown in the drawing. This also divided the edge of the hole into six parts. Two circles were scribed on the plate at ¼ in. from the hole and ¼ in. from the periphery; incidentally, I did this when marking out the plates before cutting the holes.

On the outer circle (memories of Mansion House to Broad Street via Willesden !) make a centrepop at $\frac{3}{16}$ in. to the right of each point where the radiating lines cross it. On the inner circle (Mansion House to Cannon Street via South Kensington, still running !) make a centrepop at $\frac{5}{16}$ in. from each radiating line on the opposite side to the previous ones. Drill the lot with a No 41 drill, with both plates clamped together, and before parting them mark each so that they can be replaced with the holes lining up.

The plate with the smaller hole will need bushing for the motor spindle. Chuck a piece of 1 in. round rod in the three-jaw, face, centre and drill No 30 for ⅜ in. depth. Open out to a bare ¼ in. depth with a drill the same size as the motor spindle. Turn down ¼ in. length to a tight fit in the hole in the plate. Part off at $\frac{1}{16}$ in. from the shoulder. Drill the piece of rod left in the chuck with ½ in. drill to ⅛ in. depth and part off a $\frac{1}{16}$ in. washer. This bush and washer should not be fitted until the rotor is assembled and direction of rotation ascertained.

VANES

To make the vanes, cut out six pieces of 22-gauge brass, ¼ in. wide and 2⅜ in. long. Lay these in a row like railway sleepers, not less than ¼ in. apart, on a piece of asbestos millboard. Lay a straight piece of 3/32 in. copper wire across them at $\frac{5}{16}$ in. from each end, like rails. Fix up the lot so that they won't accidentally move, then silver solder the wires to the strips. Pickle and wash off, cut the wires between the strips as indicated and bend the strips to a slight radius as shown, with the bits of wire on the concave side.

Next, find out which way the motor runs, looking at the commutator end. If it is anti-clockwise the fan will run in the direction of the arrow when it is erected, and the vanes should be fixed as shown. If clockwise, just turn the plate over and erect the vanes with the curves the other way round, as the convex side should lead. Now set out the vanes on the plate with the pins through the holes and put on the other plate with the pins going through the corresponding holes, just like putting a clock together.

Put two or three clamps over the plates to prevent their coming apart, and carefully rivet the projecting ends of the pins over so that the plates are clamped tightly to the vanes. It is absolutely essential that the plates should not be distorted in any way so make sure you hit the pins and not the plates.

Make four centrepops equidistant around the flange of the bush—don't distort that either !—put on the washer and drill four No 51 holes through the lot. Insert the bush through the hole in the fan plate from the inner side of the fan and drill four No 51 holes through that, using those in the bush-flange as guides. Put on the washer and rivet the lot together with $\frac{1}{16}$ in. rivets.

STATOR FITTINGS

The flange fitting on the upper plate must be made to suit the motor. Mine has a boss ⅞ in. dia. at each end so I used a 2 in. × $\frac{1}{16}$ in. brass blank for the flange, drilling a ⅞ in. hole in it while chucked in the three-jaw.

A piece of 1 in. rod was chucked and drilled ⅞ in. for a full ⅝ in. depth. The end was faced and a step $\frac{1}{16}$ in. wide turned on it to fit tightly in the hole in the brass blank. It was parted off at ⅛ in. from the shoulder, the step pressed into the hole in the blank and the joint silver soldered. Four No 41 holes were drilled in the flange and the complete fitting riveted to the top plate exactly over the centre hole with 3/32 in. rivets, as shown; after which it was

SUCTION FAN . . .

pushed on to the boss on the motor casing and fixed with a setscrew.

I made a suction funnel from a 2 in. brass blank and some bits of tube, the lot being silver soldered together; but a casting, or a bit of 2 in. cored bush metal about 1⅜ in. long, could be used. Chuck in the three-jaw, turn about ½ in. length to 1 in. dia. or whatever the inside diameter of the locomotive chimney, then bore out to about ⅛ in. less than the diameter of the outside. Reverse in chuck, face the end and turn down 3/16 in. length to 1½ in. dia. to fit the hole in the bottom plate.

Bore out the inside to a funnel-shape as shown. The outside can be finished off with the piece mounted on a stub mandrel—just a piece of rod turned to a tight fit in the throat—held in the three-jaw. The funnel is attached to the bottom plate by four rivets through the flange, as shown in the drawings.

ASSEMBLY

Drill and tap the end of the motor spindle for a ⅛ in. setscrew. I just took off the end of the motor casing, pulled out the armature and spindle complete and chucked it with the commutator end outwards, holding the spindle in the three-jaw. It ran quite true and it was only a couple of minutes' work to centre and drill it with a No 40 drill and tap ⅛ in. It was then replaced, the bush on the rotor pushed over the tapped end of the spindle and a ⅛ in. hexagon-headed setscrew fitted, with a washer between the head and the bush flange. This held the rotor tightly enough and no other keying or pinning was needed.

The motor should now be run and the rotor checked off for true running. If it should wobble a little, it can easily be coaxed into perfect veracity by inserting a screwdriver at the point where it is nearest to the top plate and applying a little gentle persuasion. Don't overdo it as the 22-gauge plates bend very easily. It should run at full speed without vibration.

To get the correct length of the distance-pieces for fitting between the top and bottom plates, hold the motor vertically so that the spindle drops to the position it will occupy when the motor is running (most of them have a little end-play) then hold the bottom plate against the rotor with the edge of the suction-funnel touching it. Measure the distance between the plates, and this, plus 1/32 in., will be the length of the distance-pieces.

Chuck a piece of ½ in. rod, face, centre, drill No 10 or 13/64 in. for about ¾ in. depth and part off to ascertained length, repeating operation three times. Put the distance-pieces between the plates, securing with 3/16 in. × 1 in. commercial nuts and bolts; or make them from ⅜ in. hexagon rod if you like, screwing 3/16 in. × 40. Personally I prefer the fine threads.

When all is tight there should be not more than 1/32 in. clearance between the top of the suction funnel and the rotor plate; if more, it will suck air in there instead of through the firebox and the engine will take longer to get up steam.

Tips on using

The gadget can, of course, be used for any size of locomotive by making adaptors to fit the bottom of the suction funnel; I have about half-a-dozen. One point to watch is the weight of the motor in relation to the size of the engine. An ordinary 3½ in. gauge locomotive is heavy enough to stand the steam-raiser being inserted into the chimney without any fear of its being tipped off the rails; but with a small 2½ in. job it is a different tale, and a slight push or even a pull on the wires connecting the motor to the line plug or battery might upset the whole outfit.

To guard against this I screwed two eyes, bent up from ⅛ in. wire, into the motor casing, as shown in the general arrangement drawing. I always get up steam alongside my water-tank, on the stand of which is the line plug for supplying "juice" to the motor, so I fixed up a swinging gallows arm with a piece of gas-pipe to project out over the track.

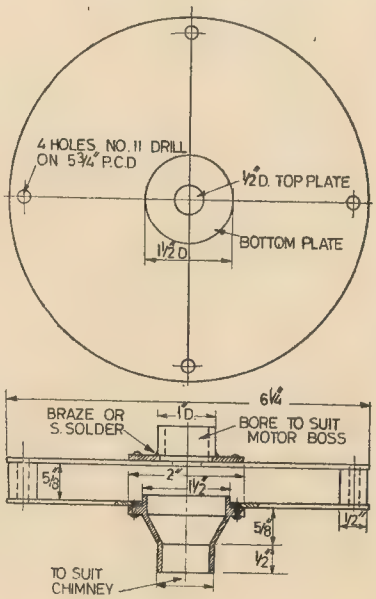
It has a hole at the end, in which fits the long screwed stem of a hook, the thread carrying a butterfly nut by which the height of the hook above rails can be adjusted. A wire loop is attached to the eyes on the motor and hung over the hook. The gallows arm thus carries the weight of the motor, and the suction funnel is instantaneously adjusted to suit the height of the locomotive chimney.

My motor has plain bush bearings, and as it was not originally intended to work end-up I found that after a little use the nut which holds the commutator was bearing hard on the end of the bush and touching the case. To stop this I turned up a little bronze bush and fitted it to the upper end of the spindle by a setscrew, with a fibre washer between the bush and the faced end of the bearing.

This did the trick, and there has been no further trouble, as the bush is adjusted so that the nut at the other end of the spindle is just clear of the casing. A better arrangement would have been to fit a little ball-thrust race between the bush and the bearing, which would carry the whole weight of the armature and fan rotor.

The end-up position of the motor doesn't affect the lubrication, as the two oil-cups contain short lengths of round felt which are pressed against the spindle by light springs; but ball-bearings would, of course, be better. The gadget is very effective but there is just one point to watch; some kinds of charcoal give off plenty of sparks when first lit, and if this kind is used with the above-described apparatus the catherine-wheel effect around it reminds one of November the Fifth ! ■

The stator or fan frame



WHY AND HOW OF SOLDERING

Soldering and Brazing by A. R. Turpin deals comprehensively with three categories—soft soldering with alloys of low melting point, hard soldering with higher melting points, and using brasses for brazing with melting points of 800 deg. C. and over. Each category is discussed from the point of view of melting point, plastic range, viscosity, strength, cost and electrical conductivity. Price 5s., postage 3d., from Percival Marshall, 19, Noel Street, London, W.1 (U.S.A. and Canada $1.00).

In this week's instalment MARTIN CLEEVE discusses saddle and cross-slide design

A LATHE you can build

Part two

WHEN DESIGNING the saddle and crossfeeding arrangements particular care should be taken to make sure that it will be possible to fully machine a length of stock held between chuck and tailstock, or between centres, without re-setting the turning tool.

This point is thought worthy of mention because I have seen a commercially built lathe which was so designed that if it was desired to commence a cut at the tailstock end, the tool would not reach the chuck or carrier end of the work by about 1½ in.

For a lathe to function properly the saddle and cross-slide dimensions will be closely related to the travel of the tailstock barrel, the overhang of the tailstock body and the width of the cross-slide. The saddle and cross-slide depicted in the photographs and drawings were designed with these points in mind.

By the way, before detailing some of the constructional features, I think readers will be amused to hear of all the criticisms I have had regarding the saddle feedscrew and "nut." This is illustrated in Fig. 1, which shows an underside view of the lathe.

Objections

Objection has been raised to the effect that the screw is not in keeping with the appearance of the rest of the lathe; that the feedscrew is too coarse; that it is a rough job, and goodness knows what else.

In building this lathe the keynote was simplicity coupled with thought for others who may wish to make one on similar lines; therefore, with those objects in view, when the question arose of finding a nice long feedscrew I thought it a good idea to use a screw and nut from an old-fashioned dining table.

The very first dealer upon whom I called had quite a selection standing in an up-ended drain pipe. The price asked was one shilling! So for that modest sum I was able to complete the lathe.

I do not say that some of the criticisms are unfounded. The screw, which has a lead of approximately ⅜ in., lacks consistent pitch accuracy and there is quite a considerable back-lash in the nut. With these faults it would not be suitable for screw-cutting; but I do say that for anyone taking the trouble to fit some reduction gearing and a clutch the screw would serve admirably for "self-act" or slow saddle traverse while, as the saddle is without rack and pinion for rapid retraction on completion of a cut, the fast movement derived from the coarse pitch screw is an advantage for quick hand adjustment of saddle position. Moreover, a screw of better quality can always be fitted at a later date as funds permit.

As was the case with most of the items on this lathe, no plans were made until it became necessary to fit the next detail and it must be admitted that when "some sort of saddle and cross-slide" fell due I entertained some misgivings.

However, after a little rough planning these gave way to elation when it was found that it would be a matter of the most absurd simplicity to fit saddle extension pieces which would ensure maximum steadiness, minimise the effect of slight bed inaccuracies and "embrace" the tailstock body in a manner customary to the larger machines but seldom seen on lathes with less than a centre height of 3½ in.

A start was made by cutting out the saddle top-plate (Fig. 2 and Fig. 3 right). This was shaped from a 4⅝ in. length of 4 in. × ¼ in. bright steel bar. The drawing carries the actual dimensions but I have shown a recommended addition at the left-hand side of the plate, say, about ⅜ in., making the overall length 5 in. This would be very useful for mounting a travelling steady or travelling chip tray to protect the bed from swarf.

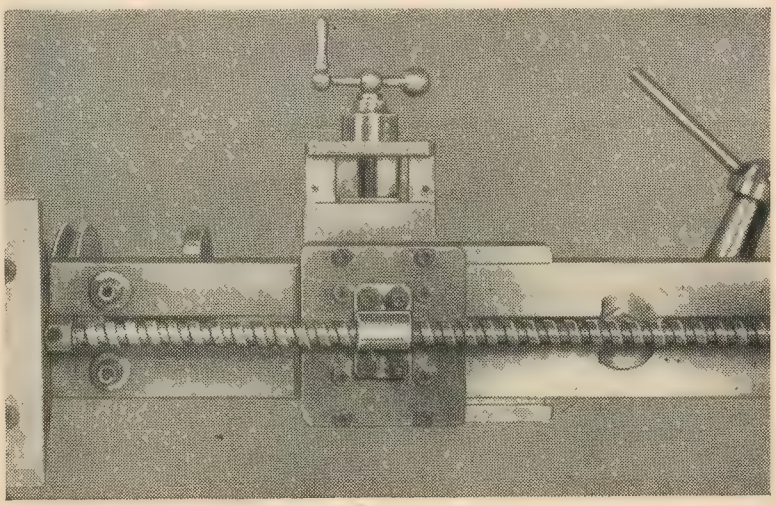
In order that the internal radii shall appear neat it is as well to drill holes of the appropriate diameter prior to removing the main pieces, but beware of the drill forming an oversize hole: I always "knock off" 1/32 in. or 3/64 in. from the diameter to make sure.

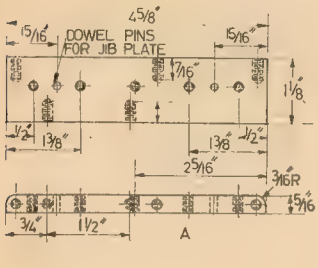
Another little point in connection with this and all other holes, the locations of which are of special importance, is that initial spot drilling with a very small drill, say 1/16 in., is recommended as a precaution against the larger drills wandering off centre.

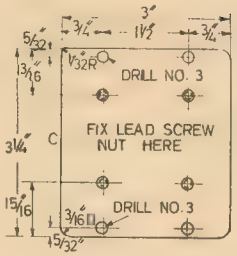
Finally, on the subject of precautions, in work of this nature, where all components are joined by means of screws entering tapped holes, it is best to drill *all* holes tapping size prior to assembly so that the various pieces may be used as drilling jigs for those parts needing tapped holes.

Returning to the main features:

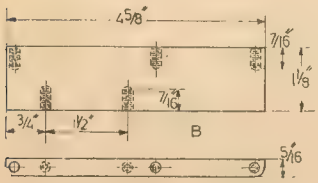
Fig. 1: *Underside view of the lathe showing the method of fixing leadscrew nut*







Left, Fig. 5: Details of the saddle plate: (a) the rear side; (b) the front view; (c) view from below. Locate the tapped holes from mating piece, using threads to suit the screws you possess



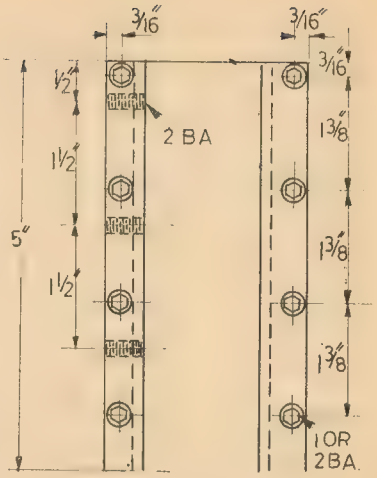
it will be noticed from the photograph (Fig. 3) that the saddle-plate and the cross-slide V-way (Fig. 3, centre) each have half a hole to accommodate the saddle cross-feed screw. Nothing, of course, can be done about this until the V-way piece has been prepared.

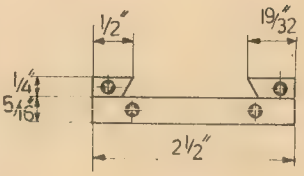
The drawing (Fig. 4) shows that this is made from a 4 in. length of $1\frac{1}{2} \times \frac{1}{4}$ in. bright mild steel. To produce the 60 deg. bevels, bolt a length of fairly heavy section, bright hexagon bar stock to the faceplate and, by means of tapped holes in that face which is "tipped" at 60 deg., clip the component to the hexagon: upon taking a series of normal facing cuts the desired bevel is produced quickly and accurately.

For smooth working of the cross-slide it is essential that these bevels be parallel within close limits, but if the square edges of the stock are already clean and parallel it is easily set by referring the rear edge to the true surface of the faceplate such as by the interposition of a piece of clean bright stock of the appropriate thickness.

To produce the half holes in the saddle top-plate and the V-way, first carefully scribe both pieces with an exact centre line. Select a lathe tool with a point similar to that used for screwcutting but provided with a shank of convenient length for hand use. Locate the tool point in the scribed line and with the aid of a clamped steel rule enlarge the width and depth by 10 to 15 thou. When both plates have been thus treated they may be fixed together.

The small impression visible at each end will serve to indicate lathe centre height by mounting between centres in the lathe. Upon clamping the assembly to the cross-slide at this height an initial $\frac{3}{16}$ in. dia. drill will follow the hand made "hole"





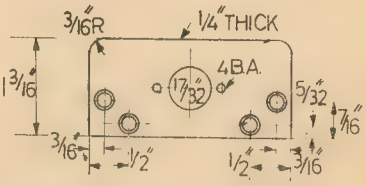
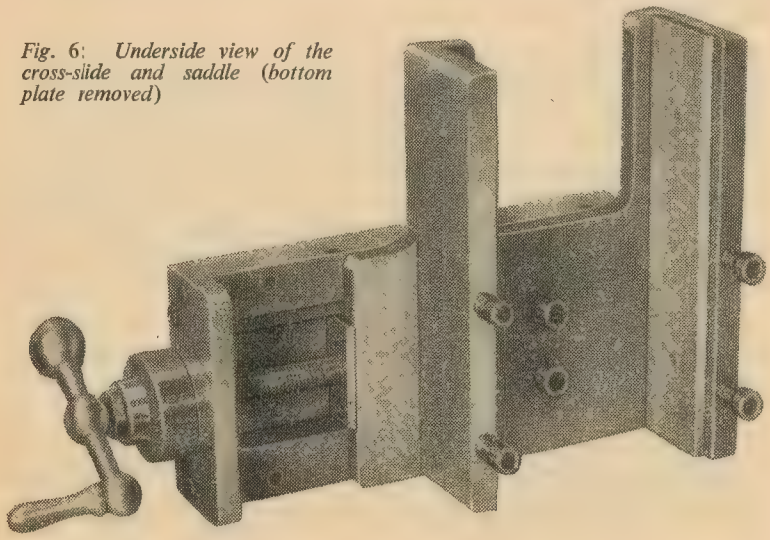


Fig. 7: The cross-slide

Fig. 6: Underside view of the cross-slide and saddle (bottom plate removed)



with exactitude. As the simultaneous drilling of two separate pieces of metal in this manner produces small chips not unlike those from cast iron, frequent withdrawal of the saddle is necessary to clear the drill.

In this case the hole must clear a cross-feed screw of $\frac{5}{16}$ in. dia. To allow for this and for any minor adjustment which may be needed to ensure that the cross-slide is at right angles to the bedways the $\frac{3}{16}$ in. hole is opened out to 11/32 in.

The enlargement at the front end is to allow for the fitting of a renewable cross-feed nut, the outside diameter of which is $\frac{7}{16}$ in. To produce a nice clean hole it is as well to open it out in stages by increments of 1/32 in. at a low speed. All these operations may be carried out in a drilling machine but in this case it is necessary to clamp the component

to the drill table as a precaution against snatch which is especially liable to occur when drilling half holes and which could easily damage the work and injure the operator.

Details of the front and rear saddle side-plates are given by the drawing (Fig. 5).

It will be noted from the photograph (Fig. 6) that the rear member is provided with a full length adjustable jib pad. Where there is a free choice of materials for this, cast iron would give the best results. Phosphor bronze would be a waste of money as it would show little improvement in wearing qualities over the 1 in. × $\frac{1}{8}$ in. strip brass which I used.

Similar remarks apply to the two jibs interposed between the bed and the under slide-plate which also holds the leadscrew nut. Of course, the remainder of the saddle offers a steel to steel sliding contact but this is also quite satisfactory in all cases where the loading is light and the relative rubbing speeds are slow.

The cross-slide is quite a straightforward job. The drawing (Fig. 7) shows an underside view. The two 60 deg. angle pieces may be produced by the faceplate and hexagon, method although in the case of narrow pieces it is sometimes necessary to use a somewhat greater length of raw stock in order to facilitate clamping.

While I do not much care for the discussion of untried methods I can see no good reason as to why such pieces should not be produced by taking one angular saw cut down the length of a suitably wide piece of stock, followed by careful filing. This would be somewhat tedious but not necessarily inaccurate.

Having got the bevelled edges flat and straight these could be used as a reference for facing the square edges parallel with the angular surfaces by a normal lathe facing operation.

As I made all the necessary hexagon socket-head cap screws for this lathe I was able to use some No 2 B.A. screws with heads of only $\frac{1}{4}$ in. dia., these being sub-standard. To meet these cases, where it is not desired to make special screws, the use of countersunk head, high tensile, hexagon socket-head screws is recommended. Screws with quite small heads of the countersunk type can be tightened easily to a degree far greater than the corresponding sizes in mild steel with screwdriver slots.

The question of feedscrew choice, dial graduating and fitting has formed the subject of recent articles, so further reference may be safely omitted except to state that the screw is $\frac{5}{16}$ in. B.S.F. and the dial has 50 graduations.

It is strange that when one's thoughts are directed into a given channel the mind is stimulated and as a result of preparing these notes I have, in connection with another little project, obtained some quite exciting results in the fabrication of T-slotted components and the preparation of a topslide of quite "thin" dimensions with plenty of "travel." I am looking forward to the final tests and the presentation details.

● *To be concluded*

Figs. 2 and 4: Details of the cross-slide V-way and the saddle top plate

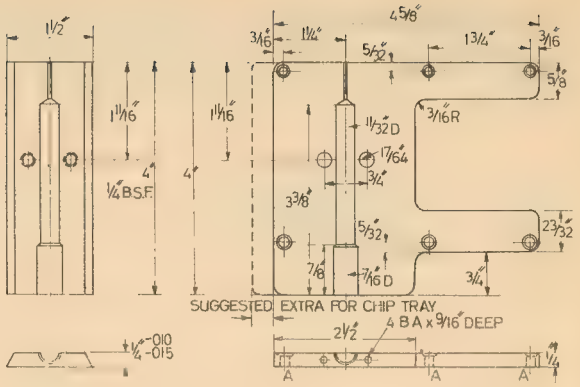
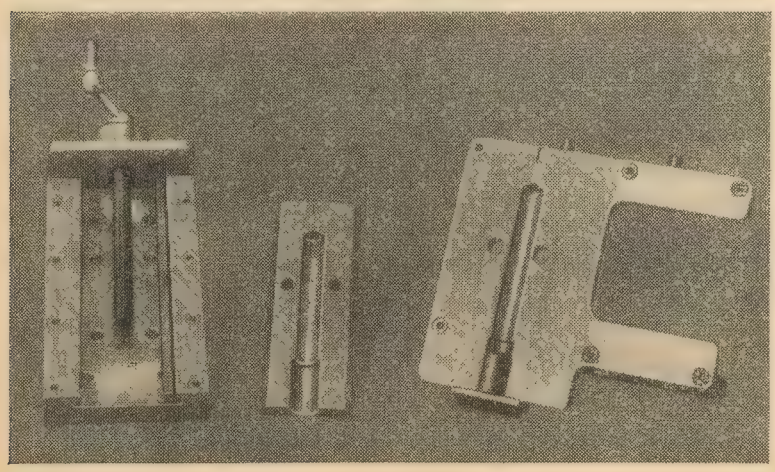


Fig. 3: The author found the fabricating of these saddle and cross-slide components quite fascinating



HOME MECHANICS

The 15 ft caravan, whose construction is dealt with in each issue of *Home Mechanics*, was paid a pretty compliment by a leading expert recently. "Of all the home-built caravans I have seen," he said, "this is the only one that will run true and keep both wheels on the ground."

This remark, flattering as it is, is no more than is expected because every article in *Home Mechanics* is thoroughly vetted by a panel of experts before it is accepted for publication and in this way complete accuracy is assured.

In the current issue now on sale for example are practical and authoritative instructions for making concrete pillars, a child's folding chair, a metal weathercock, house nameplates, brass candlesticks, an accurate sundial, an ornamental poker and a host of other useful gadgets for use in and around the home.

Other features include book reviews, descriptions of new tools, readers' ideas and letters, questions and answers, etc.

Home Mechanics costs 1s. 3d. and is obtainable from all booksellers and newsagents on the third Friday of every month. In case of difficulty, a postal order value 1s. 6d. addressed to the Sales Manager, *Home Mechanics*, 19-20, Noel Street, London, W.1 will bring a copy by return of post

By DUPLEX

Making a wobble saw

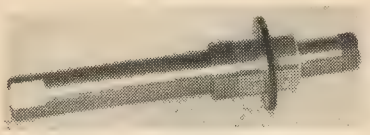


Fig. 1: *The finished wobble saw*

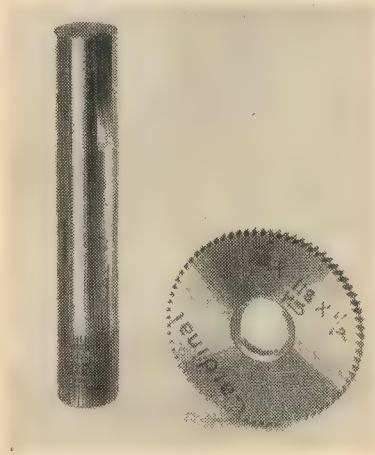
THOSE who have used circular saws or milling cutters for slitting or slotting wood or metal will have found that if the cutter is mounted so that it runs out of truth and wobbles the kerf cut is wider than the thickness of the saw.

This fact can be taken advantage of to enable slots and keyways to be machined to various widths with the use of a single cutter. The essential requirement is that the saw must be mounted with its transverse axis lying at an oblique angle to the axis of rotation, but at the same time the cutter must revolve with its teeth running truly in the radial direction.

To obtain a setting of the cutter than can be varied at will in the plane of rotation, the saw or cutter is mounted on an arbor furnished with collars which have their abutment surfaces machined obliquely in the radial direction. Fig. 2 shows a keyway, 5/32 in. in width, cut in a length of mild steel to a depth of $\frac{1}{8}$ in. by a single passage of a circular milling cutter having a width of 0.118 in.

This kind of operation may be found invaluable when a keyway has to be cut in a shaft to match one of, say, metric dimensions already machined in a gear wheel or other attachment where accurate fitting is essential for reliable working.

Fig. 2: *A keyway cut with the saw arbor*



With woodwork the possibilities are even greater, and Fig. 3 shows a series of slots of six different widths cut merely by altering the angular setting of a single, narrow circular saw.

The actual dimensions of these saw cuts, which are shown in Fig. 4, correspond to the various settings engraved on the adjusting collars of the saw arbor; the range of adjustment provided extends from the zero position to a maximum obliquity equal to an angle of 3 deg. By using a wood saw in this way toothed joints can be readily machined to enable components to be accurately fitted together; the slots are automatically machined to an identical width and a device for indexing and spacing the teeth is added to the sawing table.

A start is made by machining the arbor to the dimensions given in Fig. 5—that is if saws and cutters with a $\frac{3}{8}$ in. bore are to be used—but for larger cutters these dimensions will have to be scaled up. A length of mild steel is centre-drilled at either end by centring one end in the four-jaw chuck and supporting the projecting portion in the fixed steady. In addition these conical centres have been recessed to protect the working surfaces from being inadvertently damaged; a small boring tool is used to machine the recess while the work is still supported by the lathe steady. After a flat has been filed or machined on the inner end of the arbor it is mounted between the lathe centres and driven by a carrier engaging the dog of the catchplate.

When machining the arbor the $\frac{3}{8}$ in. dia. portion should be left 30 thou. or so oversize and the remainder of the spindle then machined. Finally, the slender portion is turned to size and the abutment shoulder faced. The reason for this is to correct any distortion that may have taken place as a result of removing the outer layers of the material.

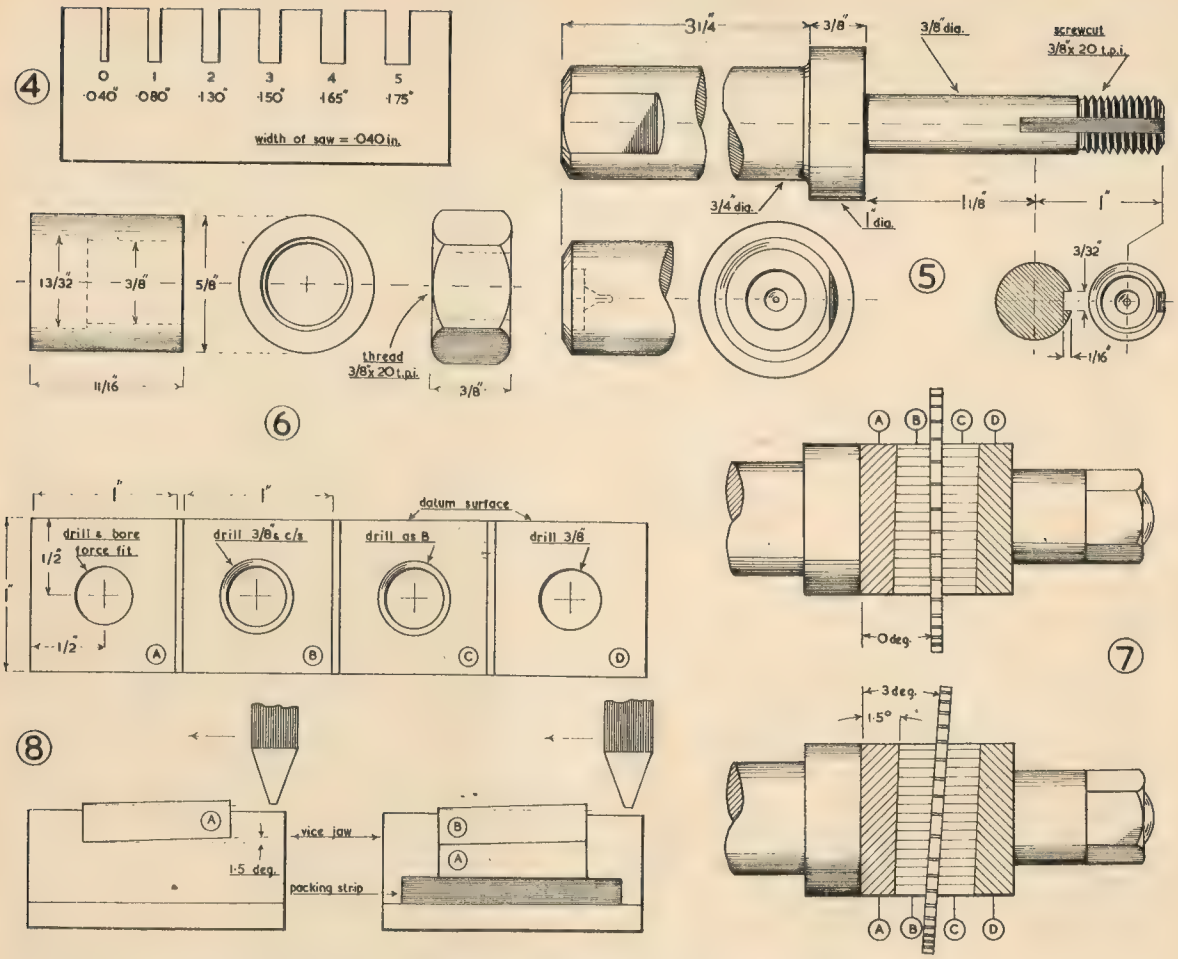
To ensure accuracy it is advisable to screwcut the $\frac{3}{8}$ in. B.S.F. thread for the clamping nut. The nut and clamp collar are illustrated in Fig. 6 and it should be noted that it is important to machine the collar with its two faces parallel otherwise it will tend to bend the spindle when the clamping nut is fully tightened. To finish the arbor it is set up in the lathe or milling machine for cutting the keyway to a depth of $\frac{1}{16}$ in. only, for the removal of metal on one side of the spindle might give rise to distortion.

Before starting to machine the arbor collars be sure you are familiar with the method of construction which enables the cutter to be given an oblique setting. Reference to Fig. 7 will show that there are four separate shaft collars. Collar *A* is made a press fit on the spindle and abuts accurately against the shoulder formed on the arbor; this collar is machined with its outer face at an angle of 1.5 deg. to the abutment face. The two collars, *B*, and *C*, which form the mounting for the cutter, are likewise machined with one plane face and one at an angle of 1.5 deg. The remaining collar, *D*, is the counterpart of *A*, but its obliquity is formed in the opposite direction; this collar is keyed to the arbor so that it is free to slide axially but cannot rotate.

In the top drawing of Fig. 7 the cutter is mounted in the neutral position to run without wobble; this is brought about by mounting the collars, *A* and *D*, with their oblique surfaces opposed and at the same time setting the two inner collars with their outer faces parallel and so that they cancel out the angularity of the outer collars. In the lower drawing the two outer collars remain fixed, but the inner collars have together been turned through an angle of 180 deg., with the result that the fixed angle of 1.5 deg. has been doubled and the cutter now lies at an angle of 3 deg. to the axis of rotation.

MACHINING THE COLLARS

The components are made from $\frac{5}{16}$ in. mild steel—or duralumin can be used for greater ease of machining as the various surfaces are but little subjected to wear. A strip of the selected material is filed or machined true on both surfaces and one edge is also accurately finished to serve as a datum surface. Paint the surface of



the material with marking fluid and mark-out the four collars and their bore centres.

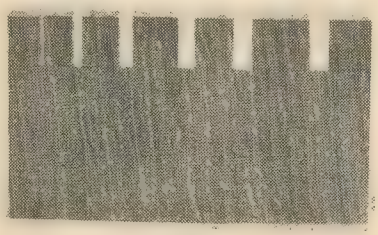
The three collars, *B*, *C* and *D*, can be drilled to the finished size and the bores of *B* and *C* are countersunk at either end to allow them to lie at an angle on the arbor when adjustments are made. The collar, *A*, is drilled undersize and afterwards bored to an interference fit on the arbor spindle.

Grip the work in the vice of the machine hacksaw, if the workshop is so equipped, and cut off the four collars to length.

Next, as shown in the lower drawing of Fig. 8, the collar, *A*, is mounted in the shaping machine vice with its upper surface set at an angle of 1.5 deg. so that it can be machined flat and the part made wedge-shaped. After this collar has been raised on a packing strip it is used as a guide for machining the collar, *B*, to the same angle but in the opposite direction. In every case the datum edge of the work serves to locate the collar against the fixed jaw of the machine vice.

Fig. 4: *The width of the slots machined by adjusting the arbor setting.* *Fig.* 5: *The dimensions of the arbor.* *Fig.* 6: *The arbor clamp-nut and collar.* *Fig.* 7: *The saw set in the neutral position and* (*below*) *with the maximum degree of angularity.* *Fig.* 8: *The workpiece for making the four collars* (*above*) *and machining the collars in the shaping machine* (*below*)

Fig. 3: *Slots of various widths cut with the wobble saw*



Finally, the collars, *C* and *D*, are machined in a similar manner with a wedge angle of 1.5 deg. This method of machining the angular surfaces should eliminate any errors of working, and the finished collars when fitted together to form a pile should lie with their end surfaces parallel.

● *To be continued.*

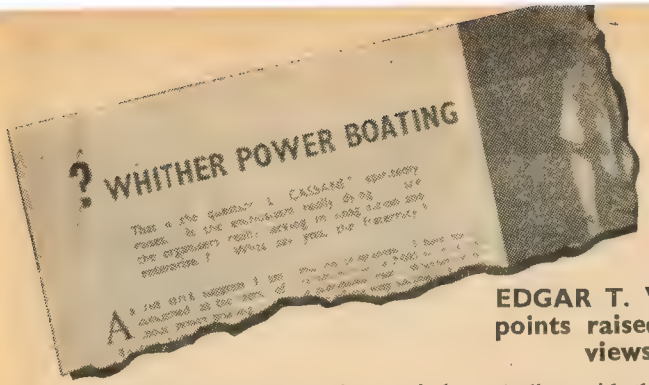
M.E. ALLCHIN SHEETS

Two more sheets in the Allchin Traction Engine series are now available in the Percival Marshall Plans Service. They are:

Sheet 12: Arrangement and details of steerage, ashpan, firegrate, water lifter, and mechanical lubricator.

Sheet 13: Lubricator details, footboard, toolbox, gear casings and draincocks.

The sheets cost 3s. 6d. each and may be obtained from Sales Department, Percival Marshall and Co. Ltd, 19-20, Noel Street, London, W.1.



THE FUTURE OF MODEL POWER BOATING

EDGAR T. WESTBURY comments on some controversial points raised in a recent article. A selection of readers' views on the same subject appears alongside

MR CASSANET'S article "Whither Power Boating" [January 31] has produced a prompt and vociferous response from readers, as was fully expected. So many letters on the subject have been received that it is impossible to publish them in full, and the Editor has asked me to sum up the opinions expressed, adding to them my own views on the matter.

I have hitherto refrained from debates of this nature because, in the course of a long experience as an officer of the Model Power Boat Association, I have found most of its decisions have been the result of long and, on the whole, wise deliberation on the part of the committee, which is composed of representatives of individual affiliated clubs and therefore, in principle at least, typical of generally accepted views.

I would, however, like to clear up one or two points on which there may be some misapprehension. First of all, the M.P.B.A. does not dictate the policy of clubs in organising and running their own regattas, except in such matters as concern standing rules.

Clubs may run any competition they so desire, and encourage any development in either the type of craft or the manner of its navigation. In the two annual regattas organised by the M.P.B.A., the International and the Grand, the main consideration is to get in a very full programme in the time allotted and give every competitor a fair chance—by no means a small task. Naturally the simplest and most easily organised competitions must take precedence.

It is, however, up to clubs to promote any ideas which they consider conducive to progress, always remembering that those which involve complicated rules or calculations are hardly likely to become popular, either with competitors or officials. It is not as easy as it looks to organise acceptable "new" competitions.

Secondly, the M.P.B.A. is not, nor has it ever been, antagonistic to radio control; on the other hand it has done everything possible to encourage it. Any *apparent* difficulty radio control devotees may have encountered in dealings with the M.P.B.A. has been simply due to cautiousness of approach to new problems in organisation, rules and classification. It has been considered that encouragement should be given to *good* boats fitted with radio control, rather than crude rafts with a radio receiver aboard—which is what some of them might easily develop into if the rules were not very carefully framed.

Thirdly, if the only interest in model boats was purely from the competition aspect they would lose much of their attraction where serious model engineers are concerned. Go to any regatta you like and you will find that the main topics of conversation are not which boat wins or is likely to win, but design of hulls and engines, methods of construction, how to improve on past performances or rectify faults and errors.

This is what really keeps activity alive, and though material progress may be slower than one might wish the answer to "Whither Power Boating?" is that it is slowly but surely going in the right direction.

R.C. events

MAY I commence with an observation on the demon TV. It would be foolish indeed to discountenance the effect of this ready-made entertainment on the model engineering movement.

In common with Mr Cassanet, I too deplore the decline of the four-stroke and flash steamers, although the latter have never been numerous, but with regard to glo-plugs I suggest that they have become popular because of their suitability.

Concerning the criticisms of lack of variety in regatta events, I shall be interested to see if any practical suggestions are forthcoming. As to the point about the short period a boat is actually running in a regatta, this is a matter simply limited by total time available. Supposing five minutes per boat were allowed in an event—this means only 12 competitors per hour, per event; exactly what we are up against with radio control contests at the present stage of development. Short of limiting entries (*that* would not be popular !) I cannot see anything to help except to avoid all undue delays.

The statements about radio control boats seem to me to be rather wide of the mark: for example, the hearsay regarding straight runners at the Grand with radio control fitted. I have the official list before me; most of them were familiar regatta boats and, eliminating those known *not* fitted with radio control, it makes even a figure of 10 per cent. a generous estimate for the remainder.

The recommendations (since ratified at the A.G.M.) for radio control speed events were formulated at a full committee meeting at which the radio control interest was strongly represented. My records show that up to now boats of over 15 c.c. engine capacity have not yet appeared in M.P.B.A. radio control events. One exception is Max Coote's *Lutece* which, I understand, is over 30 c.c. The decision to allow four cylinder jobs up to 30 c.c. was made because the power developed is so much less than that of a single or twin of similar size.

The association has always to bear in mind, when forming new rules, that all regattas are held on publicly-owned waters. One slight accident in the past year (not an radio control boat) has instantly resulted in a ban on power boats at a certain club's water. The thought of a really hot 30 c.c. single-cylinder job, weighing up to 45 lb., let loose on an ordinary size pond horrifies me.

Sidcup, Kent. JOHN H. BENSON.

Organise teams

FREE-RUNNING offers a far larger scope for power boating than racing, but speed does not matter. One's fancy for any type of boat can be given full play, moreover there is an almost equal chance of success by all, with not such a hair-splitting need for efficiency.

The remedy for the various shortcomings of power boating does not rest with the committee of the M.P.B.A. but with the clubs who form the association, the committee having to legislate for whatever the clubs demand. It is in the clubroom that the fate of power boating rests.

The Blackheath club's annual regatta is always held on the Sunday following their Saturday evening meeting, when the final briefings are given to everybody. Each knows his task,

when to run, when to return to his task.

An M.C. is appointed to see that every person does his job and to replace anyone having to leave his post. These measures ensure a warm welcome to visitors with a good day's sport, and they keep it that way right to the end of the regatta; a most important point.

Many clubs seem to consist of a gathering of individuals rather than team-mates, and it is as individuals they attend regattas, not as clubs. Regattas should be held on the lines of an inter-club competition, teams being chosen by their clubs and events organised for team competitions.

This would mean more competitions in club life, so that each member could strive for a place in any team, free- or pole-running, not necessarily racing. In turn this could be carried through in a fixture list to an annual club championship as is the way in other sporting clubs.

London, S.E.6. J. H. JEPSON.

Limiting size

DURING the past five or six years I have been constantly in touch with the powers that be in the M.P.B.A. and I am prepared to admit that in the earlier days they were, to say the least of it, somewhat "difficult" and sceptical in the manner of the old horse cabby. This is quite understandable; in fact it applies equally to the model yachting fraternity.

Now as far as the M.P.B.A. are concerned I am quite convinced that they are now fully aware of the possibilities of radio control and are endeavouring to formulate a set of rules for existing conditions, and I am glad that I have been able to assist them with advice based on my long practical experience, in practically every radio control boating contest in this country and abroad during the past six or seven years.

The recommendations for radio control speed events which the M.P.B.A. have drawn up were intended to cover the M.P.B.A. international speed contest, for which I have presented the trophy, and it is not unnatural that I should in the main endorse them.

With regard to the limitation of engine capacity to 15 c.c. (I have a very nice 30 c.c. boat !), we all know that some people do crazy things and as there is no limitation in the size of the boat if there was also no limit on the size of engine there would be nothing to prevent some clot turning up with a 10 ft boat fitted with a 100 c.c. engine !

Birchington-on-Sea,
Kent. Lt Col H. J. TAPLIN

Poles for boat control

By
S. L. HORNBY

THE LONE HAND who grimly carries on with his hobby, having to try out his craft on some local water, needs a light portable pole that can be fairly easily anchored. Here are some ideas for such an occasion.

The sketches show three different types of pole. They are all made up from the same materials. The centre pole is $\frac{3}{4}$ in. o.d. conduit pipe, the anchor plate being approximately $\frac{1}{16}$ in. sheet steel and the vanes at the bottom of the poles on No 2 being the same material.

No 1 pole is very suitable for a flooded field. Yes, flooded fields ! They are ideal. The centre pole is in two pieces, the bottom piece 42 in. long having a sleeve to accommodate the top half 24 in. long. This sleeve is a tight fit on one half and a sliding fit for the other. The sleeve is furnished with a steel bush at the top in which is tapped a $\frac{1}{4}$ in. Whit. hole to take a thumbscrew.

The anchor plate is 14 in. dia., slightly coned and fitted with a steel bush, again tapped $\frac{1}{4}$ in. Whit. for another thumbscrew to locate the anchor plate on the pole at any desired depth. This steel bush is best welded into the centre, although there are various ways of fixing it.

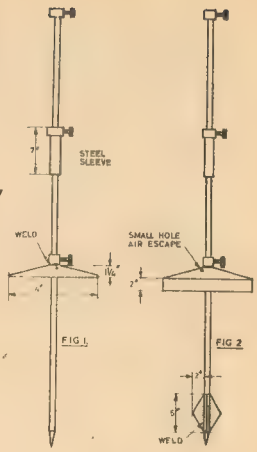
The slight cone can easily be put on the anchor plate by cutting the disc and taking out a narrow V and then riveting up. The extreme bottom end of the pole is fitted with a hardwood pointed plug.

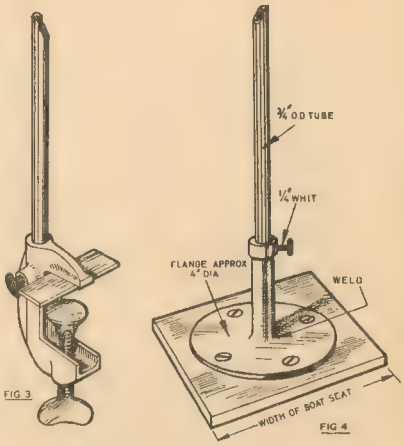
For a lake with a sandy bottom a similar pole is used with two additions as shown in No 2. A vertical rim 2 in. deep is either welded or riveted on with small brackets, and the extreme bottom end is provided with three small vanes.

The rim on the anchor plate is sunk into the sand to the full depth. This anchors the pole, and the vanes stop the extreme end from yawing in the sand. It will be found that the pole will go easily into the sand.

No 3 sketch depicts a pole suitable for a lake which is too deep to wade, but where a rowing boat is available. This pole consists of a length of tube fixed to a suitable strong clamp which in turn is fixed to the centre seat of the boat.

I made use of an old clamp off a wringer, but other methods can be used, e.g. sketch No 4. A length of steel tube is welded to a steel flange approximately $\frac{1}{4}$ in. thick and screwed to a $\frac{3}{4}$ in. board which is clamped to the boat seat. The whole idea of these poles is to have a pole that is fairly easy to transport and easy to set up.





All the steel bushes fitted with thumbscrews can be made from large nuts bored out in the lathe and made a push fit on the o.d. of the tube. The thumbscrews can easily be made up from $\frac{1}{4}$ in. Whit. bolts to which has been brazed or welded a cross-piece to the head.

Some enthusiasts may say that the pole section is light for the job in hand; however none of mine have been bent and I would say that it would take a rare pull to bend $\frac{3}{4}$ in. o.d. conduit steel pipe.

For the line attachment I use a suitable steel bar to fit the bore of the pipe fitted with a small ball-race and housing to attach the line. This part is also detachable and when in use is held in position by the usual $\frac{1}{4}$ in. thumbscrew.

I have omitted this last detail from the sketches for the sake of clearness and I reckon that each person has his own idea of what is necessary for the line to run round on.

When setting up the poles for a run the bottom end should be submerged in the lake bottom to be about 2 ft. ▣

READERS' QUERIES

Do not forget the query coupon on the last page of this issue

This free advice service is open to all readers. Queries must be on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope and query coupon with each query. Mark envelope "Query," Model Engineer, 19-20, Noel Street, London, W.1.

Steam-tight unions

Is there any satisfactory method of rendering ⅛ in. steam pipe cone unions steam-tight without the difficulty of removing them from the locomotive and possibly having to replace with a new union ?—K.G.M., Bromley, Kent.

▲ *It is assumed that you refer to the type having taper-coned nipples, permanently brazed or soldered to the pipe. However, it is rather difficult to make them steam-tight if the surfaces have been burred or otherwise damaged. It might conceivably be possible to lap the surfaces by making aluminium or copper laps of the required shape to fit both male and female surfaces and fitting a pilot in each case, to align them with the bore of the fitting. These should be applied with an oscillating movement not continuous rotation—with fine aluminium oxide or similar lapping medium. With care and patience it should be possible to renew the surfaces, unless the damage is very extensive.*

Radio under water

Can radio waves operate under water ? If so, I take it that a submarine can communicate with its base while it is submerged, thus obviating the need for its aerial to be above water. The purpose of this query is to establish whether a radio-controlled model submarine would be a practicable proposition.—L.H., Penzance.

▲ *The transmission of radio waves through water presents serious technical difficulties and, so far, only very limited success has been attained in experiments with them. Owing to the high conductivity of water the waves are "short-circuited" and dissipated before travelling very far; in addition, any apparatus carried inside a submarine hull is very effectively screened. Some success, however, has been attained with sonic and supersonic vibration waves for underwater communication and control, but no exact details of the kind of apparatus employed are available.*

Beginner's engine

I have a very good workshop where I have done a great deal of work—turning, fitting, etc.—but I have never made a model steam-engine.

I should like to build one and obtain a set of castings from Stuart Turner. But not knowing anything about steam I am puzzled on how to deal with some of the bits. I could turn up a crankshaft easily enough out of the solid, but do not know how to set up a two-throw casting unless I make special webs and bolt them on to the ends of the shaft. Can you help me ?—S.J.P., Fowey, Cornwall.

▲ *Your suggestion of making special webs to bolt on to the ends of the shaft is quite practicable and is accepted practice in certain classes of work. It is, however, essential that the webs—or throw plates as they are usually called—should be rigidly fixed and, in cases where forgings are employed, it is usual to provide suitable lugs on the end of the shaft to take the throw centres. These are, of course, cut away afterwards and the shaft journals machined to the required size.*

It is also practicable to build up the crankshafts for small steam-engines and in some cases brazed construction is employed, but satisfactory results can be obtained by making the journals and crank pins a good interference fit in the webs.

Insurance coverage

Can you tell me which insurance firms cover passenger liability and boiler risk on miniature railways ?

I would also like to know if there is a book which deals with small narrow-gauge locomotives—such as contractors' engines, Rotterdam's steam tramway locomotives, mountain railway locomotives and works' locomotives.—R.A.D., Salisbury, Wilts.

▲ *Most insurance companies will cover passenger liability and boiler risk on miniature railways. At least several people have taken out policies with Lloyd's on what appeared to be very reasonable terms.*

Regarding your second question, no book is known dealing solely—or even primarily—with small narrow-gauge locomotives. These have, however, been subjects of many articles published in "The Railway Magazine" and other periodicals over a great number of years.

Painting Petrolea

I am engaged as a beginner in building *Petrolea* to the instructions of L.B.S.C. Can you advise me of a publication which would enable me to paint the model correctly when it is finished ? I have a very clear memory of the blue, but none of the details. If there is no publication available could you tell me the colour of the frames, wheels, buffer beams, the inside of the cab and details of the lining ?

I was very surprised to see a picture of a *Claud Hamilton* G.E.R. locomotive in a recent issue of MODEL ENGINEER, and to learn from it that at least one of them had survived until British Railways took over. Can you advise me whether any drawings of this locomotive can be obtained and if directions for constructing a model of this class have been published ?—C.G.R., Carlton, Victoria, Australia.

▲ *There is no publication now existing that would provide you with the details of the painting of the old Great Eastern locomotives. The Locomotive Publishing Company once produced an excellent coloured postcard of one of the Petrolea class of 2-4-0 engines, but this card has not been obtainable now for many years. However, the main colour was a rich ultra-marine blue. On the cab splashers, footplate edging, including foot steps, and also on the tender frames and body, there was a black border with a red line on its inner edge next to the blue. The wheels were blue with black tyres and the bosses had the axle ends outlined with a red circle. The buffer beams were bright red, bordered with a narrow black margin, having a white line on its inner edge. The inside of the cab was usually painted a light-straw colour.*

There are now none of the Claud Hamilton class engines running in their original condition, but there are several which have been rebuilt with large boilers, and they look like being in service for some years yet. It is hoped shortly to feature this class in the MODEL ENGINEER *series "Locomotives I Have Known"; as to drawings, Greenly Models of* 66, *Heston Road, Hounslow, Middlesex, may be able to help you.*

Passenger carrying

Is gauge 1 large enough for passenger carrying ? I would like, if possible, to make a half-size L.B.S.C. *Virginia* for this purpose.—G.S., Birmingham.

▲ *Gauge* 1 *is much too small for use on a passenger-carrying track. Today 3½ in. gauge is usually regarded as the smallest on which passengers can be carried with any comfort and safety.*

POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

HOT-AIR ENGINES

SIR,—The recent letters on hot-air engines [Postbag, January 24 and February 21] remind me that I have often wondered what sort of results could be obtained from a hot-air engine made on steam-engine and boiler lines. The " boiler " would be a specially and suitably designed pressure reservoir containing the source of heat and as much heating surface as possible.

The air in this reservoir would be heated to the highest degree permissible for all-round results. The heated air (compressed because it cannot expand) would be released through a regulating throttle to an engine or motor on steam-engine lines and which would embody a feed pump to feed atmospheric air into the heating chamber at a rate sufficient to make good that released through the engine and so maintain pressure.

London, S.W.16. F. R. PICKARD.

TAY BRIDGE ENGINE

SIR,—In answer to reader W. C. Coulticol [Postbag February 14], I can certainly say that the locomotive involved in the Tay Bridge disaster was again put to use, very soon in fact, as she was surprisingly little damaged. But No 224 was never allowed to cross the Tay again, for sentimental reasons.

Years later No 224 was rebuilt as a tandem compound, but this experiment did not last long and she was restored to her original design. In 1897 she was again rebuilt by Matthew Holmes. The solid bogie wheels were retained.

By then the ban on crossing the Tay had been lifted. In 1913 she was re-numbered 1192 and remained in service until 40 years after her tragic accident, when in 1919 she was broken up.

Bexley, Kent. D. R. TETLEY.

SIR,—After spending three months at the bottom of the Firth, No 224 was raised between two salvage boats and towed to the shore, but suffered a second ducking en route when the lifting chains broke. Damage to the engine was found to be little more than superficial and she was sent to Glasgow for an overhaul.

For the next 26 years No 224 worked east coast expresses until she and her contemporaries were relieved of this duty by the famous North British Atlantics.

It is said that for many years no engineman could be persuaded to work No 224 across the Tay, but time dims most sentiments and on the twenty-ninth anniversary of the disaster she hauled the same Sunday night down mail over the new Tay Bridge.

Sunderland. C. DE BRUS.

SIR,—The locomotive, N.B.R. No 224, which went down with the first Tay Bridge was raised three months after the disaster, and was very little damaged. Dugald Drummond repaired her with few alterations and she ran till 1886, when Matthew Holmes rebuilt her as a four-cylinder compound on W. H. Nesbit's system.

She finished her long life on the Border Counties line between Riccarton and Hexham.

Sevenoaks, Kent. S. V. LEYTON.

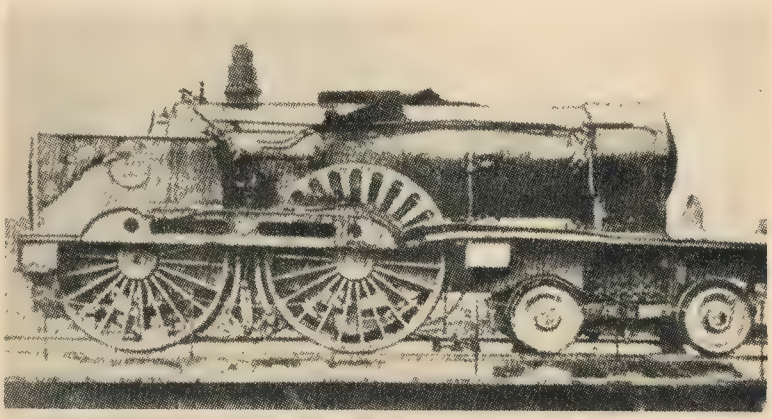
SIR,—W. C. Coulticol is correct. In *The Railway Magazine* for January 1955, John W. Grant says that No 224 was built at Cowlairs by Wheatley in 1871, and that she was the first 4-4-0 British locomotive with inside-cylinder and inside-frame.

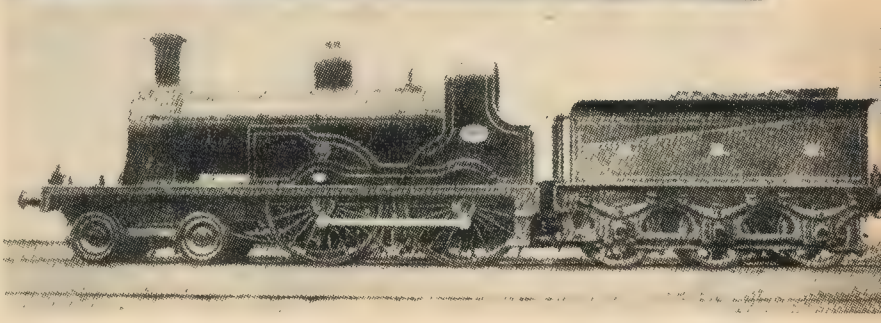
Leeds, Yorks. DONATI O. WHITEHEAD.

TO WHOM . . .

SIR,—Being a reader of MODEL ENGINEER since 1912, I think the magazine is always interesting and well up to standard, with one exception.

The engine involved in the Tay Bridge disaster after she was salvaged and, below, how she looked after re-building in 1897





POSTBAG . . .

The exception concerns advertising. Some of the advertisers are still good by modern standards, but even this falls very far behind what we used to expect in the old days.

In the past we could order on Sunday and receive goods by Wednesday, or a very nice note telling us why they could not be despatched.

Recently, I sent an order to one of your constant advertisers. I heard nothing for 14 days, but when I enquired at the bank I found my cheque had been cashed within two days of sending the order, but six weeks later I was still waiting for the goods, or some satisfactory explanation.

Wellingborough. A. FREEMAN.

TRUCK STOLEN

SIR,—I recently had a driving truck stolen from my garden railway and I should be glad if you would give it a little publicity, because the sharp eyes of the fraternity might spot it.

Its distinguishing features are: 5 in. gauge, eight wheels made of dural, and a frame made of Dexion slotted angle. The most noticeable feature is that the wheels are mounted on four front-wheel cycle hubs, in two pivoted bogies.

Orpington, Kent. HAYDN D. SMITH.

REALISM IN MODELS

SIR,—The other day I had the opportunity of examining a miniature triple-expansion marine engine. This model was well made, its constructor obviously having gone to much trouble, for it was almost perfect.

Yes, *almost* perfect, but yet not quite, for the builder had done what so many other model engineers do—he had used cheese-head screws on the cylinder covers !

The use of screws on cylinder covers is, unfortunately, to be found on very many models—marine, stationary and locomotive engines. I know that it is practically impossible to use studs and nuts on very small models for which screws just *have* to be used. In such cases hexagon-headed screws would, indeed, go far towards maintaining realism.

There are one or two other points which detract from realism in models, particularly model locomotives, and these are (1) screws to retain connecting and coupling rods on crankpins, and (2) the number of such screws employed per cylinder. The former is an all too common failing and one which professional builders are as guilty of as are amateurs. Regarding the latter, I was recently shown a model locomotive (a very fine steamer) which had four screws to retain each cylinder cover, whereas its prototype has 16 studs !

Southall, Middx. M. A. HARRISON.

DEAN SINGLES

SIR,—I think the photograph shown here answers Mr Balleny's query about the shape of the raised portion of the driving axlebox cover of the Dean Single [Postbag, 21 February].

I too noticed the peculiar rounded octagonal effect on most of my collection of photographs of these engines and I think Mr Maskelyne's explanation is right, but I will add a speculation of my own. These covers would be castings, finished by hand and any inequalities would show in photographs.

If Mr Balleny examines his l.h. three-quarter view of No 3032, *Agamemnon*, he will find that the back port of the cover shows rounded corners. The radii, incidentally, are $3\frac{3}{4}$ in. outer and 2 in. inner.

As for the air-pump lubricator, it is interesting to note that this is a standard feature on all G.W. engines fitted with air pumps even today.

Mr Keiller [Postbag, February 7] recently commented on whether the thin lining out should be yellow or orange; Swindon kindly provided me with a lining and painting diagram covering a period from 1875 to 1947 and this shows that from 1881 to 1947 the standard colour has been orange chrome.

Maidenhead, Berks. D. G. WEBSTER.

MOWER BLADES

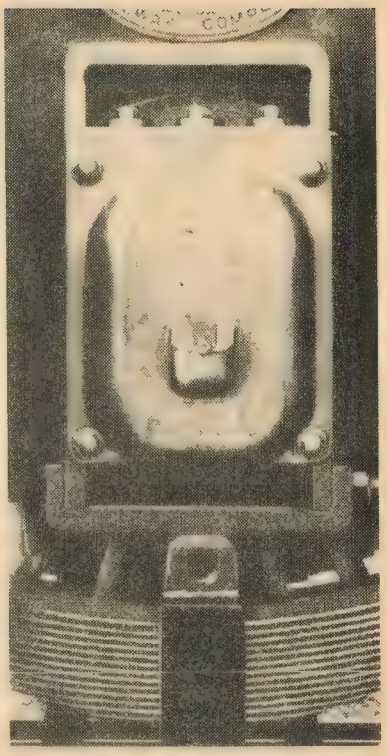
SIR,—With reference to the discussion arising from the reply to a query in the issue for December 27, this reply was in conformity with the methods employed on machines made specially for this purpose.

I have seen several of these machines in use and I have noted that they are somewhat primitive versions of plain cylindrical grinders as used for normal engineering production. On inquiring whether it would not be better to grind them with cutting clearance (not "positive rake" as stated by Mr K. Stocker), like a milling cutter, I was told that this had been tried but that it did not give any better results and the edge did not last so long.

A possible reason for this may be found in the particular cutting action of the blade; it is not a penetrating cut, as with most kinds of tools with which engineers are familiar, but a shearing action, in conjunction with the fixed blade adjacent to the cylinder. Many forms of shearing devices are made without cutting clearance, no doubt to produce maximum strength at the cutting edge.

In the circumstances, it would appear that cylindrical grinding of the blade is quite satisfactory, even if not theoretically correct.

London, W.1. EDGAR T. WESTBURY.



Showing the peculiar rounded octagonal shape of the axlebox covers on the Dean Singles

SILVER SOLDERING

SIR,—I would like to suggest to G.E.C. Renfrewshire [Reader's Queries, 21 February] that he try the method used by myself for silver soldering the flue tubes of small boilers.

The tubes are mounted in the normal manner, i.e. in the front tubeplate and the firebox tubeplate, then the ends are slightly swelled inside the firebox with a taper punch. The firebox is then supported on firebricks, open end to the burner and the tubes and front tubeplate towards the ground. The ends of the tubes are anointed with flux, and the fire blown up to dull red in the usual manner.

The heat is contained within the box and there is little or no risk of burning or melting any tubes. All

ends are accessible, inspection being possible through the firehole.

Check to see that the solder has run through to the outside of the box.

Newtown, Mont. T. WHITAKER.

COLOUR SCHEME !

SIR,—My goodness ! So, according to Mr Wheeler [Postbag, February 21] the Commies have daubed their political colour on certain copies of the MODEL ENGINEER, just as they have done on London Transport buses, trolley buses and trains; post office vans and pillar boxes. A serious state of affairs indeed !

The position of the MODEL ENGINEER, however, is more serious. I seem to remember occasions when the cover has been blue, indicating a Conservative outlook; and green—Great Scott ! Would it be the I.R.A. in Noel Street ?

For the love of mike keep politics out of our attractive journal. To me, model engineering knows no racial prejudice or colour bar; it is more likely to ensure world peace in this way.

London, E.12. W. J. TURNER.

SIR,—Let me hasten to assure you that such absurd colour phobias are *not* the rule in this locality, and that your attractive covers *are* appreciated in Windsor.

For heaven's sake let us enjoy our mutual interests without the intrusion of jarring "politics," and let Mr Wheeler remember that MODEL ENGINEER readers must include people of all shades of political opinion, most of whom find a welcome relief from the strifes and controversies of the outside world in the pages of MODEL ENGINEER.

Windsor. E. A. LOVELL.

SIR,—On reading Mr W. H.. Wheeler's letter I don't know whether to express shock or surprise.

I like red. I am in the process of painting my house red, though it's not for any political reason whatsoever, and heaven forbid that I shall ever become a communist.

Wolverton, Bucks. P. N. COPAS.

SIR,—The opinion expressed by W. H. Wheeler is not typical of model engineers, and is much to be deplored. The admirably coloured covers of recent issues are exciting, and therefore carry out the true purpose of a magazine cover.

If the colour red is so nauseating to Mr Wheeler, what are his reactions to the Union Jack or the "Red Duster." There are "reds" of the deepest political hue among readers of MODEL ENGINEER, yet I have never heard any complaint when the MODEL ENGINEER has been arrayed in garments of a truly beautiful blue

Our enjoyment of this amateur craft is to be found not just in the work of our own hands but in the work of others as well, work that is carried through with the pride and care of a craftsman at his best, untainted by any thought of worldly materialism and profit.

Leeds, Yorks. K. MARSH.

BUILDING "VIRGINIA"

SIR,—As a matter of possible interest to you and L.B.S.C., I have just finished a complete *Virginia* chassis with Walschaerts' valve gear, which functions very nicely on air test. Except for the leaves of working springs, all is ready for boiler construction.

Ohio, U.S.A. ROBERT T. EBERT.

● *It is always interesting to hear from readers who are building models described in* MODEL ENGINEER. *We should like to hear from others who are constructing* VIRGINIA.—EDITOR.

IT WAS A SPARE

SIR,—In reply to P. C. Trowes [Postbag, February 14] I regret that I do not remember the name of the gentleman in question. I remember him as a person, but do not recollect the name Trowse.

Points from letters . . .

Does any reader know what taper was used in the 4 in. Britannia lathe ? Mr F. Livesey, of Heatherland, Budleigh Salterton, Devon, has a trusty Britannia of 1911 vintage and the centres which he has made show a taper of 0.09 in. per inch of length.

* * *

W. H. Dobbs, of Wolverhampton, pops up with this simple idea for marking out steam and exhaust ports in an oscillating engine.

Find a nail that fits the steam hole, cut its head off, trim so that when pressed against the cylinder wall it stands 1/32 in. proud. Temporarily assemble and wiggle the flywheel, then drill holes at the ends of the arc formed—and Bob's your uncle !

* * *

Speaking of static electricity, which seems to have occupied our readers' thoughts and pens for several months now, Robert C. Farrell, of Vancouver, reckons that the finest display of this high-voltage electricity can be seen at the "dry" end of a newsprint making machine. Sparks of one to two feet length are continuously crackling around the winding drum !

And to Mr R. L. Roberts; most heavy vehicles of the time were solid-rubber tyred, the tyres being pressed on to the wheel by hydraulic press. As it was inconvenient to carry a press in the toolbox, they were usually installed at a tyre depot.

Rather than keep a vehicle off the road it was usual to keep a spare wheel handy which might be either disc or spoke.

Barnoldswick, Lancs. JOHN T. BRYDEN.

MORE DETAIL, PLEASE

SIR,—May I express my appreciation of the drawings by Mr Maskelyne in the series "Locomotives I Have Known" and I hope this series will be continued until all of the better-known ancient and modern locomotive classes have been covered.

In addition, I would also like to see included detail drawings of such locomotive parts as chimneys, domes, safety-valve covers, diagrams of lining out, lettering, numbering, crests and really good descriptions of livery colouring, as such information is invaluable to those who build model locomotives and are the points normally criticised when models are entered in competitions.

These drawings should be on sale, preferably in black on white, and they could well be either $\frac{3}{8}$ in. or $\frac{1}{2}$ in. scale.

Berks. D.G.W.

CUTTERS' TEMPLATE

SIR,—Owing to the prohibitive cost of gear cutters most model engineers are forced to resort to fly cutting which is quite satisfactory providing one has some means of obtaining the form of tooth required.

I wonder that some manufacturer of small tools does not market

Mr Whitehead's suggestion for a template giving the gap forms for eight cutters (not to scale)

templates carrying the gap forms of the eight cutters in general use for each d.p.

These templates could be made in sets held in a clip as feeler or radius gauges.

I am sure a ready sale would be found not only among model engineers but also professional machinists.

Newport, Mon. B. J. WHITEHEAD.

CLUB NEWS

Edited by THE CLUBMAN

HALF a century ago model engineering clubs were being formed across the world. As soon as one group of pioneers had created a promising society, they reached out a helping hand to others—and so the process continued, with consequences that are enjoyed today.

Such pioneering by no means belongs to the past. This year will see the birth of new clubs and the revival of some which for one reason or other have become apathetic.

The club movement had its origin in the links provided by MODEL ENGINEER, and whenever a new club is formed its first members are almost invariably men who came to know of each other through reading these pages. In this way, for instance, J. F. Hall at Palmerston North, 88 miles from Wellington on New Zealand's North Island, discovered the existence of other enthusiasts in Palmerston North and made "quite a number of friends."

Encouraged by the success of get-together evenings already held, these modellers now hope to establish a club in Palmerston North.

"I am a farmer myself," writes Mr Hall (his address is RD. No 10, Palmerston North, New Zealand), "and so my interests are in traction engines and portable and stationary steam engines. I still have vivid memories of the 15 h.p. Tangye engine which drove the machinery in the local dairy factory many years ago."

If all goes well, Mr Hall will soon be making a W. J. Hughes Allchin with the aid of his Myford Super 7. I do not know whether this will be the first Allchin to be modelled in Palmerston North, but I am sure that it will not be the last.

In the near future Mr Hall is leaving for the Old Country, and one of the things that he wants to see on his visit is, of course, a traction-engine rally. By a rather odd irony, the enthusiasts for these live steam events are to some extent at the mercy of the internal combustion engine, and it may be that less petrol may mean fewer and smaller rallies this year. One which has been announced is the Rempstone meeting on the last Saturday and Sunday in June.

Meanwhile MODEL ENGINEER reciprocates the kind wishes expressed by Mr Hall, with the further hope that North Palmerston will have its own club during 1957. Perhaps, too, Mr Hall will find time on his visit, rushed though it will probably be, to call on us here at Noel Street? We are always particularly pleased to welcome readers from distant parts of the world.

M.E. DIARY

March 22.—Welling and District M. and E.E.S. competition night. Port Talbot, Neath and District S.M.E., discussion on gadgets and small tool adaptations. I.M.E. annual meeting, 6 p.m. J.I.E. "Gas Chromatography," H. W. D. Hughes, Pepys House, 7 p.m.

March 23.—S.M.E.E. Lecture, W. Deacon (Aluminium Development Assoc.), 14 Rochester Row, Victoria, 2.30 p.m.

March 25.—Clyde Shiplovers' and Model Makers' Society, "I Remember" (nautical yarns).

March 27.—I.E.E. "Earth Electrode Systems for Large Electric Stations," J. D. Humphries. Birmingham S.M.E. talk by Pop Morton, White Horse.

March 28.—South London Ship Society "Brixham Trawlers," W. O. B. Majer.

March 29.—World Ship Society Merseyside branch "Sixty Years of the Mersey Ferries," W. B. Hallam (illustrated by epidiascope). J.I.E. "Making Use of Russian and Czech Scientific and Technical Information," E. Gros, Pepys House, 7 p.m.

Pressure water gauge . . .

continued from page 429

Stainless steel is required for the taper plug, made to the "words and music" for small locomotive cylinder drain cocks, and dimensions are given as a guide in Fig. 3. Fitted to the squared end is a brass handle with 10 B.A. pinch-bolt and a short operating lever for remote control by rod or cable from firing floor level. Offset to the handle is arranged according to whether it is left or right hand, the latter being shown in Fig. 4.

Illumination of the gauge is by a 6 v. 3 w. festoon bulb (Fig. 8) and obtainable at electrical stores. Its housing-cum-reflector is a split, light-gauge brass tube (Fig. 6) spaced from a simple C-type mounting bracket by a little brass saddle.

Ebonite plugs with circlips of brass shimstock serve the dual purpose of mounting the bulb and making electrical contact with it. Spigots on the plugs are a push fit in the housing tube while the bulb contact caps, in turn, are a push fit in the circlips. Each plug is tapped 8 B.A. for a contact screw furnished with two half nuts and a little radio-type terminal tag to which the respective insulated conductors carrying the current are soft-soldered (Fig. 7). Note that for electrical connections a paste flux, or resin-cored solder, must be used.

When fitted the lamp housing may be mounted either left or right hand, and should have 180 deg. of movement to allow the assembly to be swung forward for access to the lamp.

Tin plating enhances the reflecting power of the housing tube and may well be used on the gauge generally to improve its appearance.

The plate glass (Fig. 5) should be about $\frac{1}{8}$ in. thick. Practice will be required on a much larger piece of glass in cutting up such comparatively small rectangles. The edges must be clean and there should be a complete absence of surface flaws or scratches because the strength of the glass resides in the skin. If difficulty is experienced secure (at a small charge) a glazier, and if toughened glass is available so much the better.

Fig. 5 also shows a 1/64 in. asbestos gasket, the cut-out portion of which is removed by using a tailor's punch and a razor blade. Four are required.

When assembling make the clamping nuts on the ten studs finger-tight only and apply a hydraulic test of not more than 150 per cent. of working pressure. During the test gradually tighten the nuts, evenly and progressively, and thus cure any leaks. Under steam, remember, some differential expansion will occur due to the range of temperature so that further attention may be required. But the criterion must be "just enough tension to cure leaks." If a leak should develop which appears to require excessive tightening of the nuts, avoid the temptation to put that extra bit of tension on; change the gasket instead.

Ensure the bulb filament is coincident with the centre lines of the glasses. Adjustment is obtained by partial rotation of the bulb in its housing. ■

Model Engineer

Classified Advertisements together with remittance should be sent to Model Engineer, 19/20, Noel Street, London, W.1, by latest Thursday morning prior to date of publication. Advertisements will be accepted from recognised sources by telephone. GERRARD 8811. Ex. 4

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WORKSHOP EQUIPMENT

Buck & Ryan for Lathes and Workshop Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661.

3″ 4-Jaw Chucks with hardened and ground reversible jaws. Body screwed for direct fitting to lathe spindles. Threaded ⅝″, ½″, ⅝″, ¾″, Whit. or B.S.F., special threads to order, 45s. p. post 1s. 3d.—S. WAKEFIELD, 8, Adams Avenue, Tunstall, Stoke-on-Trent.

3½″ Myford ML7 chucks, motor, stand, milling attachment, accessories, double bench grinder. Week ends.—24, Stamford Grove, Stalybridge, Cheshire. £60, offers.

⅝″ High Speed sensitive power bench drilling machine, £6 10s. S.A.E. details. Credit terms available.—WANSTEAD SUPPLY Co., 30, The Broadway, Woodford Green, Essex.

New Tool Bargains. 30 Whit., B.S.F., etc., H.S. taps to 1½″, £1. 30 H.S.S.S. twist drills to 15/32″, £1. 2 doz. Eclipse H.S. hacksaw blades, 9″ × ½″, 10s. 1 M.T.S. H.S. spiral end mills, 7/16″ dia., 3s. 6d. each. 25 ins and out thread chasers, all different, 10s. H.S., M.T.S. fluted reamers, ⅛″, 7/32″, 15/64″, ¼″, 9/32″, 5/16″, 17s. 6d. the 6. Set of H.S. twist drills, 1-60 on Picador stand, £2 10s. Set of Little Giant (auto. s.a.e.) stocks and dies in collets, ¼″, 5/16″, ⅜″, 7/16″, ½″, 25s. Set of B.S.F. stocks and dies (dies 1 5/16″ o.d.), ¼″, 5/16″, ⅜″, 7/16″, ½″ with 1 H.S.S. tap each size, 27s. 6d. All 2s. post extra please.—ATTFIELD, 221, Green Lane, New Eltham, London, S.E.9.

Myford ML7 on Maker's Stand with motor, s.c. chuck, tools, excellent condition £55. Haighton 2½″ lathe complete on stand, motor countershaft belts s.c. chuck and tools, new condition, £25. Set 5 expanding reamers 27/32″ to 1½″, £5. Starrett 12″ combination square centre head protractor, new condition, £4 10s. Set parallel reamers ½″ to 0.55″, 14 in set good condition, £4 10s. Runbaken Midget grinder polisher, new, £5. Set Cleveland drills 1/16″ to ½″ × 1/64″, £4. 1/3 h.p. Metro-Vick motor, 230/1/50 brand new, £5. Moore and Wright 12″ square, 15s. Wolf toolpost electric grinder suit 6″ lathe, £10.—Executors LOWE CRAIG LLWYD, Llanddulas, Abergele.

N E W

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Myford ML7 saw table comp., £5. Dividing attachment, £11. Taper turn attach, £7 10s. Flexispeed miller with c/shaft., £30. All C/paid.—T. MALLABY & Co., 66, Meadow Lane, Leeds 11.

Mail Order Only. New bargains, post packing 1s. extra under, £1. Vanadium twist drills 17 different 1/16″ to ⅛″, 13s., 29 1/16″ to ⅛″, 48s. Quality 40 t.p.i. 13/16″ dies, 5/32″, 3/16″, 7/32″, ¼″, 3s. 4d. each, ⅜″ 40, 2s. 8d. Whit. ⅛″, 4s., 3/32″, 3s. 4d. B.A. 0-1-2-3-4-5-6, 2s. 8d. each, 7-8, 3s. 4d., 9-10, 4s., 11-12, 6s. 4d. Independent chucks, Burnerd, 3½″, 67s. 6d., 4″, 72s., 4½″, 75s. Hand drills, ¼″ chuck, 10s., 3/16″, 16s. Precision drill chucks, ¼″ 1 M.T., 43s. 6d., 2 M.T., 44s. Taps, 40 t.p.i. 5/32″, 3/16″, 7/32″, 2s. each, 40 ¼″, 1s. 3d., Whit. 1/16″, 2s., 3/32″, 2s., 5/32″, 1s. 3d., 3/16″, 1s. 4d. B.A 0-1, 1s. 5d., 2-3-4-5, 1s. 4d., 6, 1s. 5d., 7-8, 1s. 8d., 9-10, 2s., 11-12, 3s. 4d. Drill stands 1-60, 1/16″ to ½″, A.Z, 3s. 9d. each. Stillson wrenches 6″, 4s. 6d., 8″, 6s., 10″, 7s. 6d. Hand grinder 6″ × 1″ wheel, 25s. Breast drills ½″ chuck, 27s. 6d. Enclosed gears type, 33s. H.S. centre drills size 1, 2s., 2, 2s. 3d., 3, 2s. 9d., 4, 3s. Dies 1″ dia. 40 t.p.i., 3/16″, ⅜″, 5s. 4d. each, 9/32″, 32, 5/16″ 32, ⅜″, 32, 5s. 4d. each, 7/16″ 26s, 5s. 4d., ⅜″ 26, 5s. 4d., 1 1/16″ dia., 7/16″ 40, 9s. 8d., ½″ 40, 9s. 8d., ½″ 32, 9s. 8d. Taps 40 t.p.i. 5/16″, 2s. 8d. ⅜″, 3s., 7/16″, 3s. 4d., ½″, 4s., 26 t.p.i. 5/16″, 2s., ⅜″, 2s. 8d., 32 t.p.i. 9/32″, 5/16″, ⅜″, 2s. 8d. each. Carpenter's ratchet brace, 14s.—S. GRIMSHAW, 7, Hall Street, Manchester, 18.

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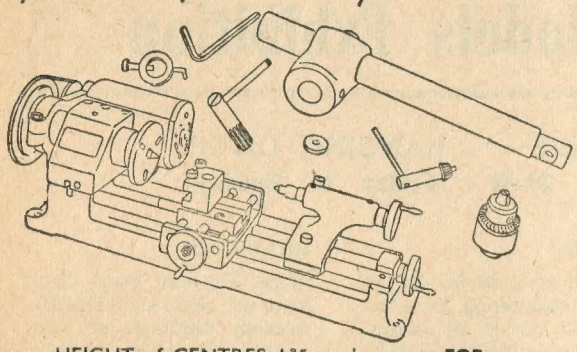

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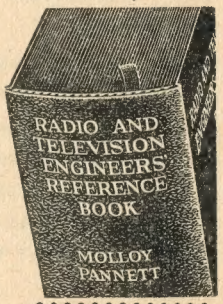

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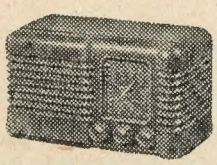

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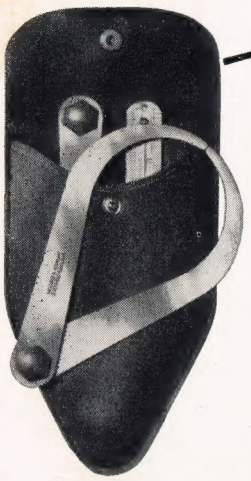

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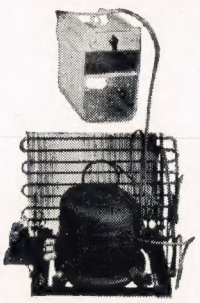

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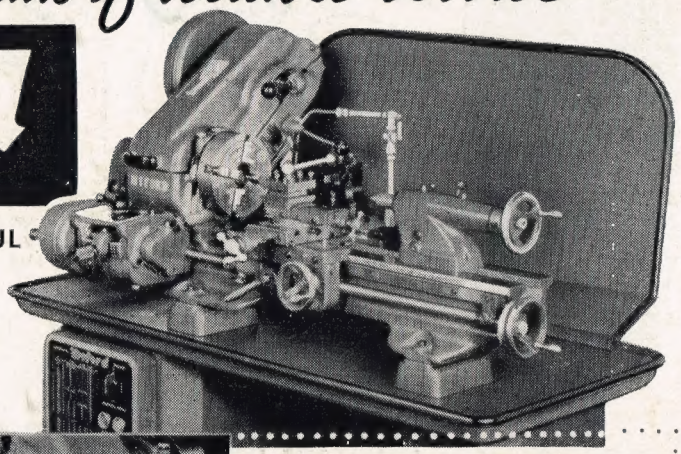

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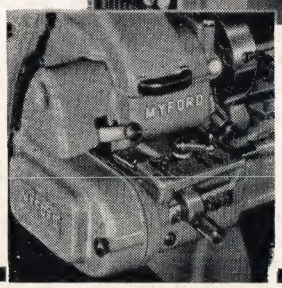
Taper Turning Attachments, Lever Operated Collet Attachments, Six Station Turret Attachments, Four Tool Turret Attachments, Dividing Attachments, Vertical Slides (Plain and Swivelling), Fixed and Travelling Steadies, Rear Tool Posts, Quick Setting Tools, etc., etc.



← ***the quick-change gear-box***

Gives a rapid selection of 48 Threads and Feeds, and is available as an Attachment for all existing ML7 and Super 7 Lathes. It is easily fitted, and OILBATH LUBRICATION ensures smooth easy operation and long life.

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HIGH SPEED SPINDLE. Has large tapered front bearing, twin angular contact rear bearings. No deflection—axial adjustment.

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CLUTCH CONTROL. Saves Time. Protects motor and switchgear.